R-WD-15-12

STATE OF NEW HAMPSHIRE

Technical Support Document for the Great Bay Estuary Aquatic Life Use Support Assessments, 2014 305(b) Report/303(d) List

MARCH 27, 2017

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

R-WD-15-12

Technical Support Document for the Great Bay Estuary Aquatic Life Use Support Assessments, 2014 305(b) Report/303(d) List

STATE OF NEW HAMPSHIRE
DEPARTMENT OF ENVIRONMENTAL SERVICES
29 HAZEN DRIVE
CONCORD, NEW HAMPSHIRE 03301

CLARK B. FREISE
ASSISTANT COMMISSIONER

EUGENE FORBES, P.E.
DIRECTOR
WATER DIVISION

PREPARED BY
KEN EDWARSON
WATERSHED MANAGEMENT BUREAU

March 27, 2017

Table of Contents

Introduction

The Federal Water Pollution Control Act [PL92-500, commonly called the Clean Water Act (CWA)], as last reauthorized by the Water Quality Act of 1987, requires each state to submit two surface water quality documents to the U.S. Environmental Protection Agency (EPA) every two years. Section 305(b) of the CWA requires submittal of a report (commonly called the "305(b) Report"), that describes the quality of its surface waters and an analysis of the extent to which all such waters provide for the protection and propagation of a balanced population of shellfish, fish, and wildlife, and allow recreational activities in and on the water. The second document is typically called the "303(d) List ", as required by Section 303(d) of the CWA, includes surface waters that are:

1. impaired or threatened by a pollutant or pollutant(s);
2. not expected to meet water quality standards within a reasonable time even after application of best available technology standards for point sources or best management practices for nonpoint sources; and,
3. require the development and implementation of a comprehensive water quality study (i.e., called a Total Maximum Daily Load or TMDL study) that is designed to meet water quality standards.

In accordance with these requirements, the New Hampshire Department of Environmental Services (NHDES) assesses all available data for lakes, rivers, and estuaries every two years to determine compliance with the Surface Water Quality Regulations, Env-Wq 1700 *et sq*. The assessments determine whether or not water quality supports specific designated uses. Designated uses are the desirable uses that surface waters should support such as swimming (i.e., Primary Contact Recreation) and fishing (i.e., Aquatic Life). The full list of designated uses considered by NHDES are:

- Aquatic Life: Waters that provide suitable chemical and physical conditions for supporting a balanced, integrated and adaptive community of aquatic organisms;
- Fish Consumption: Waters that support fish free from contamination at levels that pose a human health risk to consumers;
- Shellfish Consumption: Waters that support a population of shellfish free from toxicants and pathogens that could pose a human health risk to consumers;
- Drinking Water Supply After Adequate Treatment: Waters that after adequate treatment will be suitable for human intake and meet state/federal drinking water regulations;
- Primary Contact Recreation (i.e. swimming): Waters suitable for recreational uses that require or are likely to result in full body contact and/or incidental ingestion of water;
- Secondary Contact Recreation: Waters that support recreational uses that involve minor water contact; and,
- Wildlife: Waters that provide suitable physical and chemical conditions in the water and the riparian corridor to support wildlife as well as aquatic life.

The Great Bay Estuary constitutes approximately 86 percent (by area) of all New Hampshire estuaries. The Great Bay Estuary is a national treasure and a valuable resource to the state, and, as such, has been designated by EPA as an "estuary of national significance" under Section 320 of the CWA. The 2013 State of the Estuaries Report for the estuary (PREP, 2013) showed that the Great Bay Estuary has all the classic signs of eutrophication: increasing nitrogen concentrations, low dissolved oxygen, and disappearing eelgrass habitat. These symptoms of eutrophication have the potential to impair the Aquatic Life designated use which would be a violation of the state water quality standards for nutrients (Env-Wq 1703.14) and biological and aquatic community integrity (Env-Wq 1703.19):

Env-Wq 1703.14
(b) Class B waters shall contain no phosphorus or nitrogen in such concentrations that would impair any existing or designated uses, unless naturally occurring.

Env-Wq 1703.19
(a) The surface waters shall support and maintain a balanced, integrated, and adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of similar natural habitats of a region.
(b) Differences from naturally occurring conditions shall be limited to non-detrimental differences in community structure and function.

Given the complexity of the Great Bay estuary and the inherent challenges in assessing it, this document is meant to provide additional information about how the water quality status of each of the 19 assessment zone was determined. Specifically, this document addresses the water quality data used to determine if the Estuary meets the Aquatic Life designated use.

Regarding Numeric Nitrogen Thresholds from the "2009 Report" for the Great Bay Estuary

In response to the worrisome eutrophication trends, the department developed numeric nutrient thresholds for the Great Bay Estuary as numeric translators of the narrative standard to determine compliance with Env-Wq 1703.14 (NHDES, Numeric Nutrient Criteria for the Great Bay Estuary. New Hampshire Department of Environmental Services, Concord, NH. June 2009. (R-WD-09-12), 2009). These translators were site-specific in that they only apply to particular assessment units in the Great Bay Estuary. Numeric translators were developed for chlorophyll-a, light attenuation (a general measure of water clarity), total nitrogen, and eelgrass cover. Translators were not needed for dissolved oxygen and dissolved oxygen saturation because the State already has water quality criteria for these parameters (Env-Wq 1703.07).

The numeric thresholds for the Great Bay Estuary were used as part of a stressor–response decision matrix to determine which water body segments should be included on the 2008, 2010, and 2012 ((NHDES, 2008) Section 303(d) lists of impaired waters for nutrients.

In March 2010, EPA initiated an independent peer review of the nutrient thresholds for the Great Bay estuary. The peer review process was administered by the environmental engineering consulting firm Tetra Tech through the Nutrient Scientific Technical Exchange Partnership and Support (N-Steps) program. The reviewers found the Great Bay nutrient thresholds were well explained and supported by appropriate literature and reasoning.

Due to a high level of interest from stakeholder communities, the nutrient thresholds were reviewed by another external peer review panel consisting of four independent specialists in the fields of estuarine water quality, modeling, dissolved oxygen, and eelgrass biology. The panel completed its work in February 2014. The questions to the panel were focused on whether the report was sufficient to prove that nitrogen was the primary cause of ecological changes in the Great Bay Estuary.

The reviewers indicated that there was a reasonable basis for finding some parts of the Great Bay Estuary system impaired for eelgrass loss. The reviewers also agreed that nitrogen is an important

factor related to eelgrass and other response variables in the estuary. However, they concluded that the NHDES 2009 report did not adequately demonstrate that nitrogen is the primary factor causing eelgrass decline in the Great Bay Estuary because the report did not explicitly consider all of the other potentially confounding factors in developing relationships between nitrogen and the presence of eelgrass.

As a result of a court approved settlement agreement, the department will cease using the nitrogen concentration thresholds from the NHDES 2009 Report (NHDES, Numeric Nutrient Criteria for the Great Bay Estuary. New Hampshire Department of Environmental Services, Concord, NH. June 2009. (R-WD-09-12), 2009) to assess nitrogen impairments in its 2014 assessment. The CALM was changed to reflect that the stressor-response matrix previously used to determine total nitrogen impairment status will not be used. In the 2014 assessment, the department will assess the parameters listed above (dissolved oxygen, chlorophyll-a, light attenuation, total nitrogen, and eelgrass cover) independently relative to their respective numeric or narrative water quality standards.

In regards to total nitrogen, the department is in the process of determining new assessment approaches. Because that process is incomplete, the department will utilize existing data for each assessment unit to make a determination of impairment status. Current methods for calculating and making assessments are provided in 2014 CALM. In their comments on the draft 2014 303(d), EPA made reference to their Technical Support Document which provided EPA's rationale for the September 24, 2015 approval of New Hampshire's 2012 303(d) (USEPA, 2015). Further, EPA questioned whether New Hampshire's administrative record provided an adequate basis for the proposal not to list certain Great Bay Estuary segment/impairment combinations.

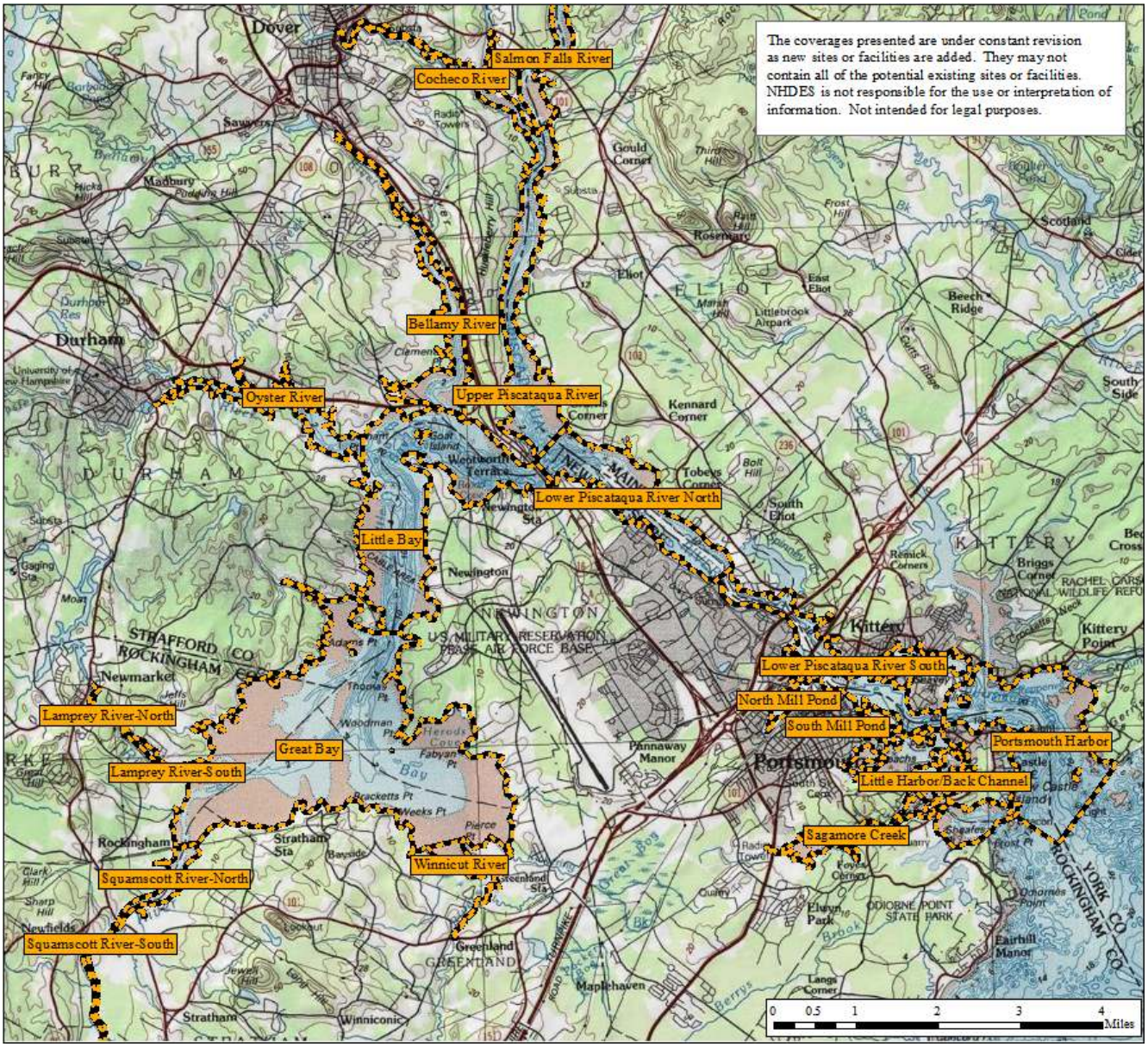
NHDES recognizes the concerns raised by EPA regarding the proposed delistings and values the subsequent conversations that occurred. From those EPA discussions it is clear that NHDES cannot make a non-assessment where data is readily available and assessments were previously completed and approved through the 303(d) process. Further, from those discussions about the Draft 2014 303(d) and the 2012 303(d) Approval (USEPA, 2015), it is clear that NHDES must have a clear and rational basis to delist any waterbody segments.

Estuary Assessment Zones

For 305(b)/303(d) assessments, NHDES uses 43 assessment units to cover the Great Bay Estuary that are coincident with the shellfish growing areas established by the DES Shellfish Program. Great Bay itself consists of seven different assessment units. Nitrogen and eutrophication parameters are logically evaluated utilizing data from larger aggregates of assessment units covering contiguous areas. Eutrophication effects are less localized than the bacteria pollution sources that affect shellfish harvesting. Therefore, NHDES aggregated the 43 assessment units in the Great Bay Estuary into 19 assessment zones. The boundaries of each of the aggregated assessment zones are shown in Figure 1. For the purposes of 305(b)/303(d) reporting, the categories assigned to these larger assessment zones will be assigned to each of the assessment units within the zone. For the Salmon Falls/Piscataqua River, the assessment zones cover both the New Hampshire and Maine sides of the main stem of the river in order to select data from both sides of the river. The river is well-mixed and data from both sides of the state line are needed to provide a comprehensive dataset for assessments. However, the impairment determinations made by NHDES only apply to the New Hampshire side of the river. The Maine Department of Environmental Protection makes its own impairment determinations for the Maine side

of the Salmon Falls/Piscataqua River. No changes have been made to the composition or locations of assessment zones between the 2012 and 2014 reporting cycles.

Figure 1. Great Bay Estuary assessment zones for the 2014 305(b)/303(d) aquatic life designated use assessments.



Eelgrass Mapping

In 2013, eelgrass was mapped in the Great Bay Estuary using two different sets of aerial imagery. As has been done since 1996, UNH (Dr. Fred Short) mapped eelgrass using low-altitude, oblique aerial photographs, while new for 2013, Seth Barker used high resolution vertical aerial imagery collected by Kappa Mapping Inc. Eelgrass extent was independently mapped using both sets of imagery. These

concurrent datasets were obtained as a way to evaluate each of the methodologies. For assessment purposes NHDES will continue to use the eelgrass mapped by UNH, as the method for collection and interpretation/delineation of eelgrass uses methods which have been consistently followed since 1996. The Kappa/barker dataset may be used as supplemental information as needed.

Water Quality Data

The NHDES Environmental Monitoring Database (EMD) is a publically accessible database containing field observations, measurements, and laboratory samples for various public, private and volunteer programs. It was developed in March 2003 and became available on the web in June 2004. Data sets are continuously being added and updated. Datasets from the EMD are the foundation of the water quality assessments. The procedures below describe the processes that were undertaken to compile and synthesis the comprehensive dataset from the EMD for the Aquatic Life designated use assessment of the Great Bay Estuary described in this document.

1. The base dataset for the 2014 assessments are the measurements collected on or after 1/1/2008 that were incorporated in the NHDES Environmental Monitoring Database (EMD) by 2/1/2014. For nutrients, this generally meant data collected through 2013. A secondary supplementary data pull was made on 10/21/2014 to capture late submitted nutrient, dissolved oxygen, and chlorophyll-a data for a subset of Great Bay waters. Further, to enhance the ability to look across cycles and into more historic data a SADB cycle = ‘0001’ was set up. Cycle '0001' houses the coastal data related to nitrogen, chlorophyll-a, light, turbidity, dissolved oxygen, water temperature, and salinity that has not always been pulled into the Supplemental Assessment Database (SADB). The minimum date age set in ‘0001’ was January 1, 1982. The cycle 0001 addition provides a common data reduction methodology to be used in subsequent data pulls and plots. The ‘0001’ pull was made on January 21, 2015.
2. The data were pulled from the EMD into the SADB by an automated query. Some of the conditions on the query were:
   a. Results marked as invalid were excluded.
   b. Results marked as Below Detection Limits (BDL) were assigned a value of one-half the Method Detection Limit (MDL). [Note: BDLs: In the nutrient criteria report, NHDES used the MDL for BDLs. In the bulk query, the adjusted value is reported as 1/2 the MDL. PREP has used 1/2 MDL for BDLs for trends in "modern" datasets. Therefore, for the 2014 assessments, NHDES will apply the 1/2 MDL approach for consistency across datasets.]
   c. Quality assurance samples were excluded. This condition removed field duplicate samples. [Note: QA samples: In the nutrient criteria report, NHDES averaged field duplicate results. In the bulk query, field duplicates were excluded. PREP has included replicates in the past but recently the TAC decided to not include QA samples to be consistent across datasets. Therefore, for the 2014 assessments, NHDES will exclude QA replicate samples for consistency.]

Aquatic Life Designated Use Assessment Summary Table

Comparison of the Final 2012 and Final 2014 assessment of eutrophication parameters for the Aquatic Life designated use in the Great Bay assessment zones. Assessment category definitions are provided in section 3.1.3 and 3.1.5 of the 2014 CALM.

De-impairment | New Impairment

Assessment Zone	Cycle	Chlorophyll-a	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Sat)	Estuarine Bioassessments (eelgrass)	Water Clarity (Light Attenuation Coefficient)	Total Nitrogen
Squamscott River South	2012	5-P	5-P	5-M	No Std	No Std	5-P
	2014	5-P	5-P	5-M	No Std	No Std	5-P
Squamscott River North	2012	5-P	5-P	2-M	5-P	5-P	5-P
	2014	5-P	5-P	5-M	5-P	5-P	5-P
Lamprey River North	2012	5-M	5-P	5-M	No Std	No Std	5-M
	2014	5-M	5-P	5-P	No Std	No Std	5-M
Lamprey River South	2012	5-M	2-G	2-G	5-P	5-P	5-P
	2014	5-M	2-G	3-PAS	5-P	5-P	5-M
Winnicut River	2012	3-ND	2-M	2-G	5-P	3-ND	3-ND
	2014	3-ND	2-M	2-M	5-P	3-ND	3-ND
Great Bay	2012	2-G	2-G	2-G	5-P	5-M	5-M
	2014	2-M	3-PNS	2-M	5-P	5-M	3-PNS
Little Bay	2012	2-G	2-M	2-G	5-P	5-M	5-M
	2014	2-M	2-G	2-M	5-P	5-M	3-PNS
Oyster River	2012	5-M	5-P	5-M	5-P	5-P	5-P
	2014	5-M	5-P	5-P	5-P	5-P	5-P
Bellamy River	2012	2-M	2-G	3-ND	5-P	3-PNS	5-P
	2014	3-PNS	3-PAS	3-ND	5-P	3-PNS	3-PNS
Cocheco River	2012	5-M	3-PAS	3-PAS	No Std	No Std	5-P
	2014	5-P	3-PNS	2-M	No Std	No Std	3-PNS
Salmon Falls River	2012	5-P	5-P	5-M	No Std	No Std	5-M
	2014	5-P	5-P	5-P	No Std	No Std	5-M
Upper Piscataqua River	2012	2-M	2-M	2-G	5-P	5-P	5-P
	2014	2-M	3-PNS	2-G	5-P	5-P	3-PNS
Lower Piscataqua River - North	2012	3-PAS	2-G	2-G	5-P	3-PNS	3-PNS
	2014	3-PAS	2-G	2-G	5-P	3-PNS	3-PNS
Lower Piscataqua River - South	2012	3-PAS	2-M	3-ND	5-P	3-PAS	3-PNS
	2014	3-PAS	2-G	2-G	5-P	3-PAS	3-PNS
North Mill Pond	2012	3-ND	2-G	2-G	3-ND	3-ND	3-ND
	2014	3-ND	2-G	2-G	3-ND	3-ND	3-ND
South Mill Pond	2012	3-ND	2-M	2-G	3-ND	3-ND	3-ND
	2014	3-ND	2-G	2-G	3-ND	3-ND	3-ND
Portsmouth Harbor	2012	2-G	2-M	2-G	5-P	5-M	5-M
	2014	2-G	2-M	2-M	5-P	5-M	3-PNS
Little Harbor/Back Channel	2012	3-PAS	2-G	3-ND	5-P	5-M	5-M
	2014	3-PAS	2-G	3-ND	5-P	5-M	3-PNS
Sagamore Creek	2012	3-PAS	3-PAS	3-ND	5-P	3-ND	3-PAS
	2014	3-ND	3-PAS	3-ND	5-P	3-ND	3-ND

Assessment Zone Data Summaries

Plot Legend and Summary Table Abbreviations

In the assessment zone summaries that follow, all data from January 1, 2000 to November 7, 2014 are displayed in the data plots for context. Summary statistics in the data tables cover the period from January 1, 2008 to November 7, 2014. The legend for a given attribute only contains indicator text for those indicators that have data available since the year 2000. The full comparison codes for the samples are predominantly those from the SADB and were used within the legend of the graphs and tables for brevity. The descriptions for those codes are provided below.

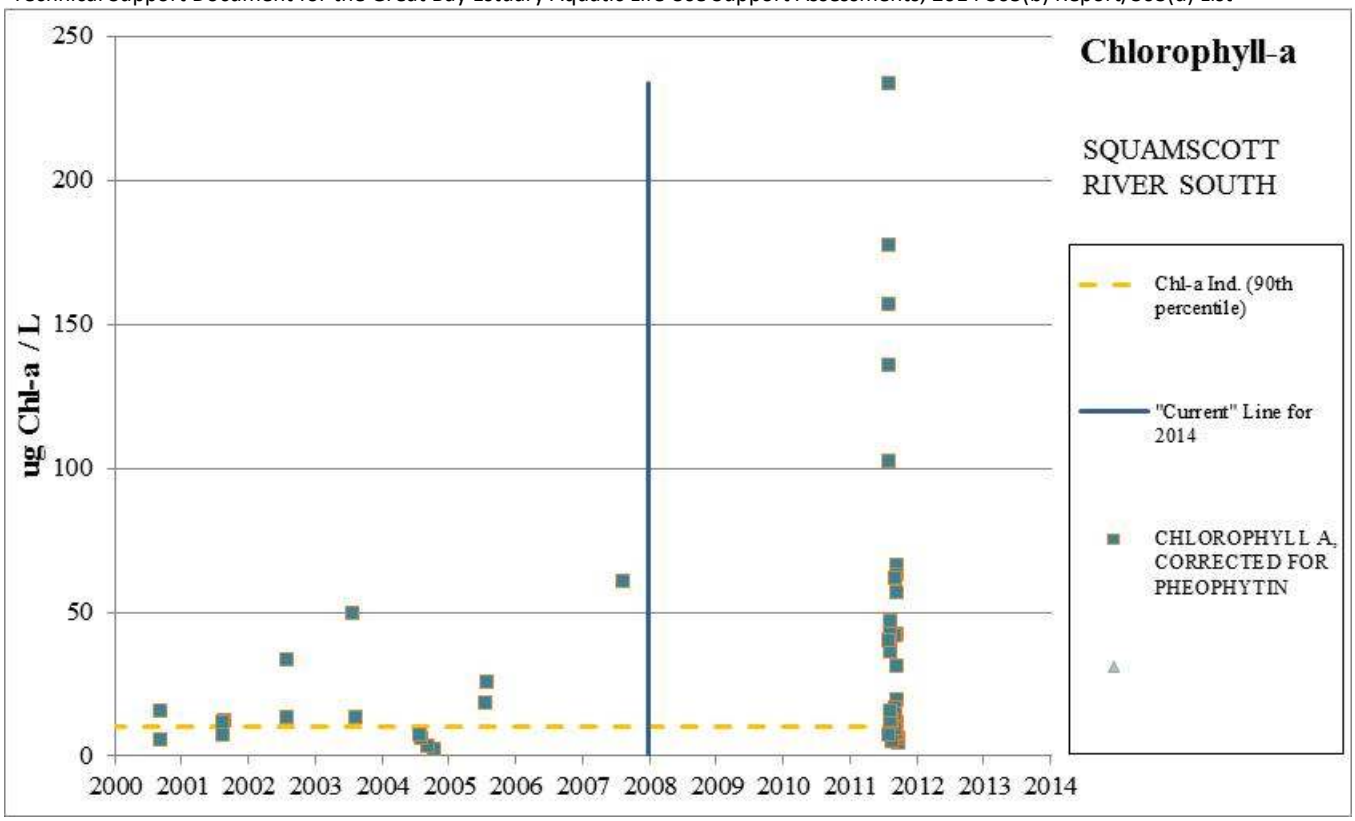
- Chlorophyll-a
  - CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN - The majority of the chlorophyll-a in the marine environment has been processed with the correction for pheophytin.
  - CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN – In a few cases samples the chlorophyll-a in the marine environment has been processed without the correction for pheophytin.
  - CHLOROPHYLL A, combined – In those cases where both corrected and uncorrected chlorophyll-a have been collected, the statistics for the combined measurements are provided.
- Dissolved Oxygen Concentration
  - DO-PPM-24HR-MIN-CP = 24 hour minimum dissolved oxygen concentration from a datalogger deployed during the summer critical period.
  - DO-PPM-24HR-MIN-NCP = 24 hour minimum dissolved oxygen concentration from a datalogger not deployed during the summer critical period.
  - DO-PPM-GRAB-CP = Grab samples of dissolved oxygen concentration during the summer critical period.
  - DO-PPM-GRAB-NCP = Grab samples of dissolved oxygen concentration during the summer critical period.
- Dissolved Oxygen Percent Saturation
  - DO-PERC-24H-MEAN-CP = 24 hour average dissolved oxygen percent saturation from a datalogger deployed during the summer critical period.
  - DO-PERC-24H-MEAN-NCP = 24 hour average dissolved oxygen percent saturation from a datalogger not deployed during the summer critical period.
  - DO-PERC-2TIDE-GRAB-CP = The average to two grab samples for dissolved oxygen percent saturation, one at high tide and one at low tide of a single day, during the summer critical period.
  - DO-PERC-2TIDE-GRAB-NCP = The average to two grab samples for dissolved oxygen percent saturation, one at high tide and one at low tide of a single day, not during the summer critical period.
- LIGHT ATTENUATION COEFFICIENT (Water Clarity) – A measurement of the light attenuation coefficient, Kd.

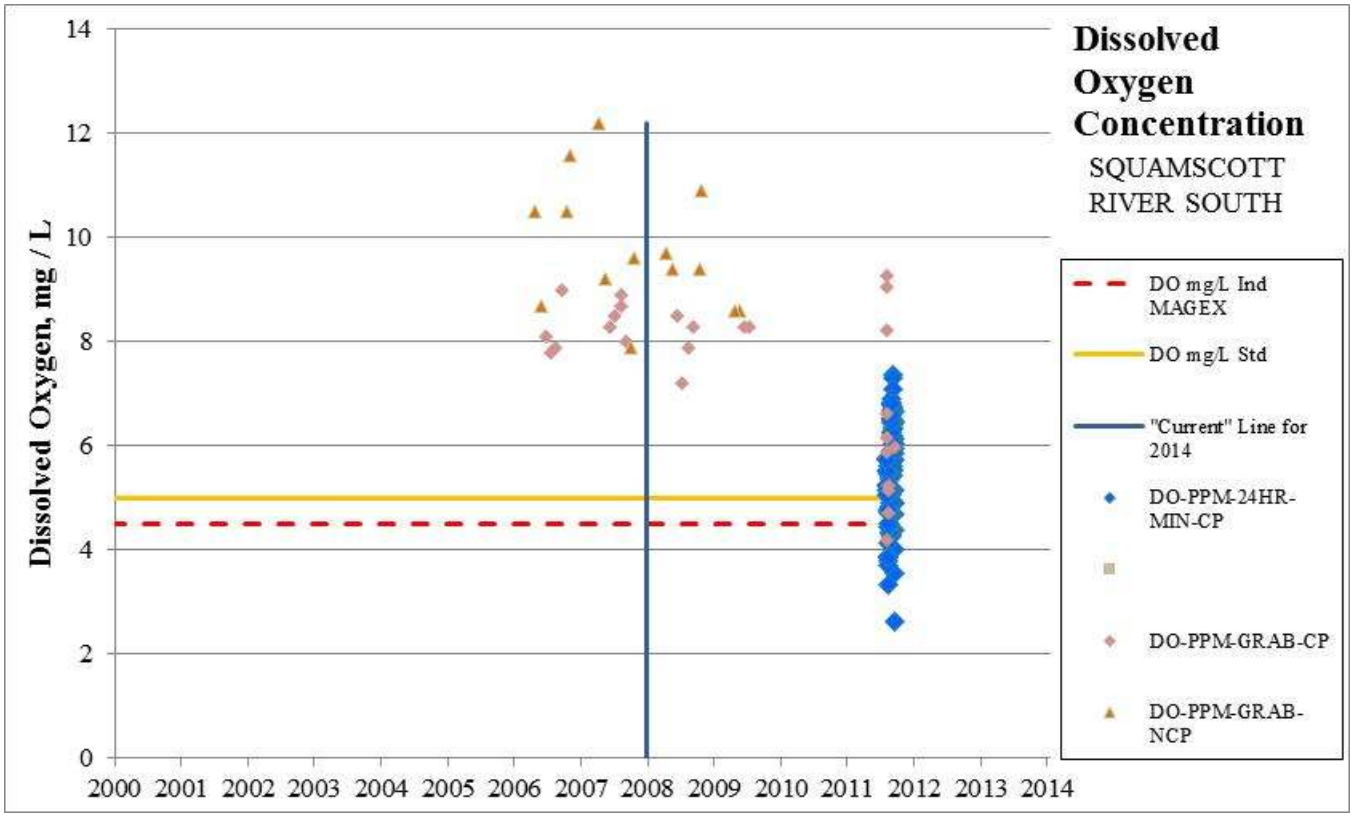
- Nitrogen – Graphics within this document plot the primary indicator of total productivity within the system, total nitrogen (TN) while the tables provide the statistics for TN and individual fractions of nitrogen. In most cases, there was one sample collected at a given station per day. Where multiple samples were collected at a particular station on a single day, those samples for multiple times and/or depths were processed as described in the sections above.
    - Day Ave of TN – Total Nitrogen
    - Day Ave of TDN – Total Dissolved Nitrogen.
    - Day Ave of DIN (NH3 + NO2/3) – Dissolved Inorganic Nitrogen
    - Day Ave of NH3 - Ammonia
    - Day Ave of PON – Particulate Organic Nitrogen
    - Day Ave of NO2/3 – Nitrite/Nitrate
- Plot Reference Lines
    - "Current" Line for 2014 - Per the methodology outlined in the CALM, all data to the right of this referenced data are considered "current". Available older data are provided for context and are needed for that historic context if newer data indicates improved conditions. See the 2014 CALM for addition details.
    - Chl-a Ind. (90^{th} percentile) – This is the reference line for the chlorophyll-a indicator. The 90^{th} percentile (10 ug/L) of the assessment zone dataset is compared to this chlorophyll-a indicator described in the CALM.
    - DO mg/L Std. – This is the 5 mg/L reference line for the dissolved oxygen standard.
    - DO mg/L Ind MAGEX – This is the 4.5 mg/L reference line for the dissolved oxygen magnitude of exceedence indicator described in the CALM.
    - DO % Sat Std. – This is the 24 hour average 75 percent reference line for the dissolved oxygen percent saturation standard.
    - DO % Sat Ind MAGEX – This is the 24 hour average 65 percent reference line for the dissolved oxygen percent saturation magnitude of exceedence indicator described in the CALM.
    - Survival Min. Ind. (median) – This is light attenuation coefficient indicator that corresponds to the minimum light needed for eelgrass to survive at the restoration depth set for a given assessment zone. The median of the assessment zone dataset is compared to this light attenuation coefficient indicator as described in the CALM.
    - TN Gulf of Maine (median) – This is the median total nitrogen in the Gulf of Maine. This reference line is provided as a consistent point of reference across assessment zones.

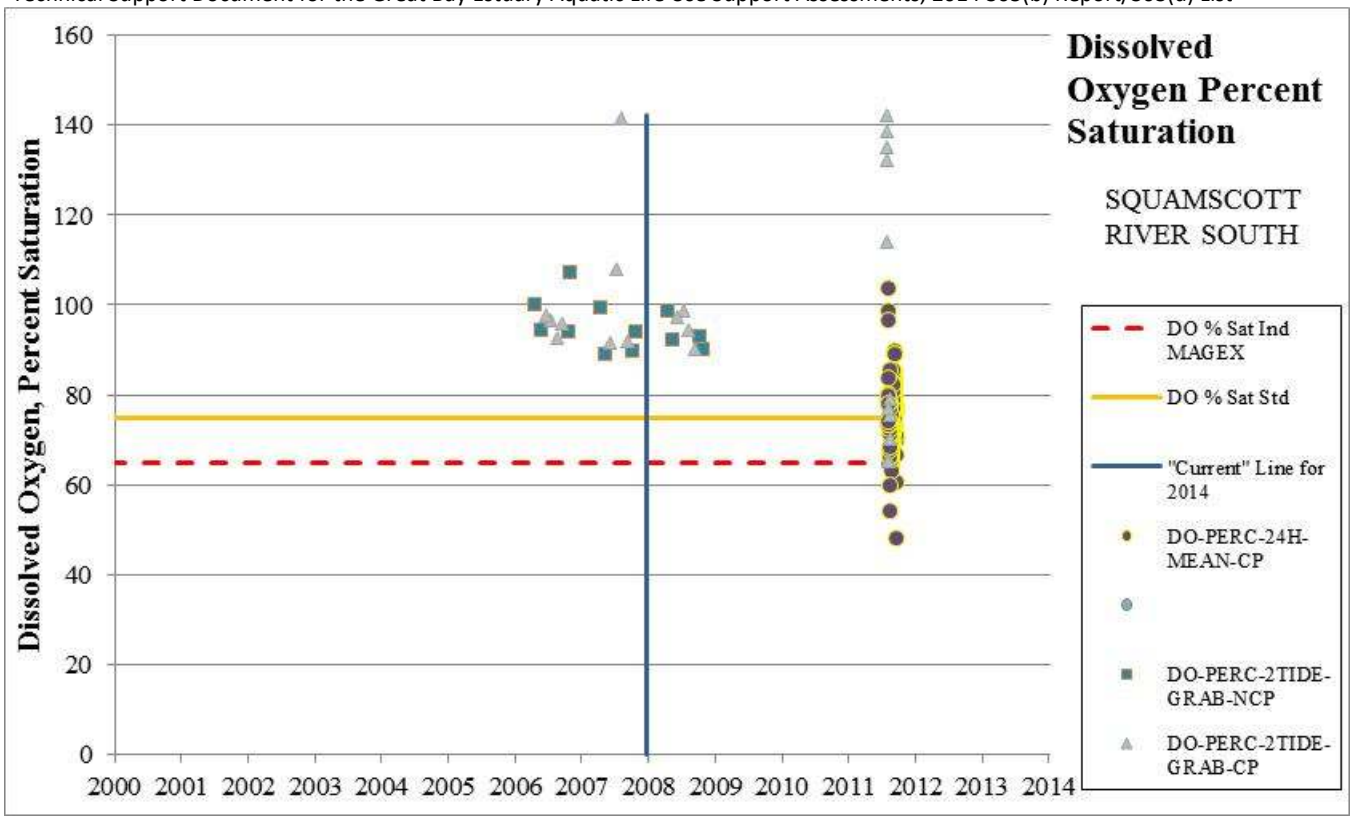
Assessment Zone = SQUAMSCOTT RIVER SOUTH

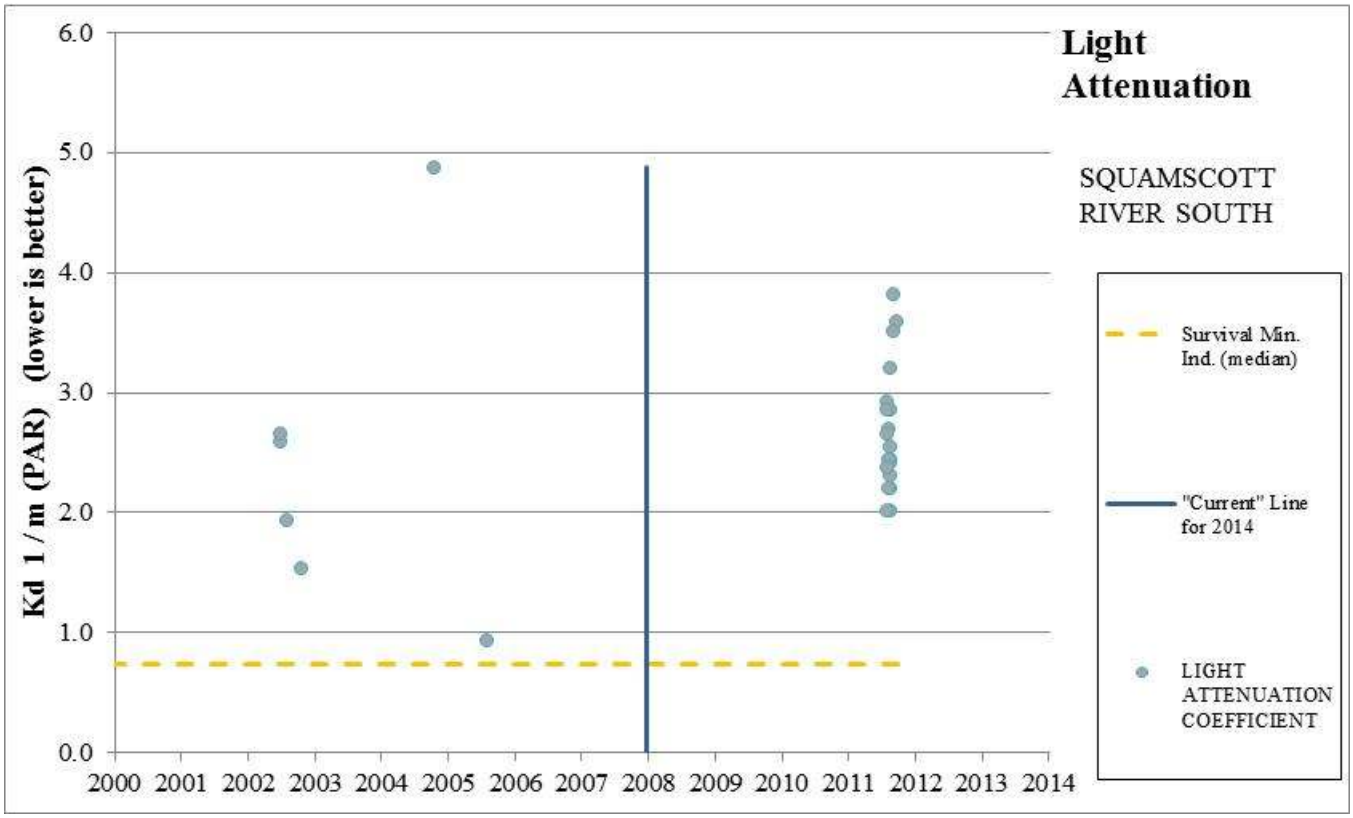
(NHEST600030806-01-01)

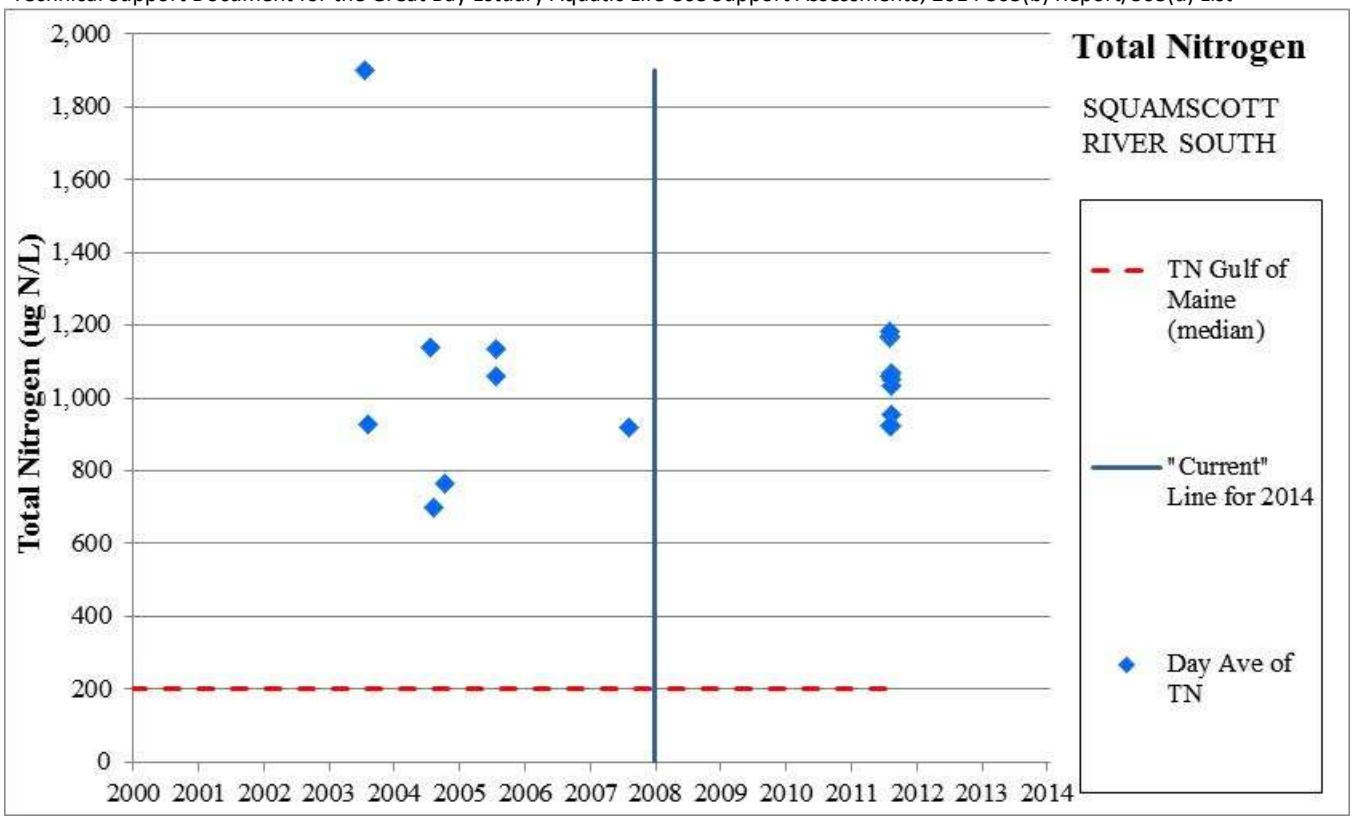
Indicator	Aquatic Life Use Category 2012 / 2014	2014
Chlorophyll-a	5-P / 5-P	No chlorophyll-a data has been collected in the Squamscott River South assessment zone since 2011, which was reported in the March 2012 report by HydroQual, consultants for the Great Bay Municipal Coalition (HydroQual, March 20, 2012). That data showed numerous measurements in this assessment zone of 50 to greater than 200 ug/L. The calculated 90th percentile chlorophyll-a in this assessment zone is 136 ug/L (n=39). The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L. Additionally, there are still frequent dissolved oxygen concentration and percent saturation criteria exceedences.
Dissolved Oxygen (mg/L)	5-P / 5-P	The most recent dissolved oxygen data that has been collected in the Squamscott River South assessment zone was in 2011 and reported in March 2012 by HydroQual, consultants for the Great Bay Municipal Coalition (HydroQual, March 20, 2012).That data showed numerous violations of the dissolved oxygen concentration and the daily average (24 hour) percent saturation standards in this assessment zone. The report documents water quality sampling, including datasonde deployments, conducted by UNH in the Squamscott River in August and September 2011.
Dissolved Oxygen (% Saturation)	5-M / 5-P	See Above
Estuarine Bioassessments (eelgrass)	No Std / No Std	Not applicable. Eelgrass habitat has not historically existed in this assessment zone. This assessment zone was created for the 2012 cycle by splitting the Squamscott River assessment zone (assessment unit ID = NHEST600030806-01) into two pieces. The parent assessment zone was listed as impaired (5-P) for eelgrass loss on the 2010 303d list. For the 2012 list, the impairment was associated with the other child assessment zone (Squamscott River North; NHEST600030806-01-02) because eelgrass has not historically existed in this assessment zone.
Water Clarity (Light Attenuation Coefficient)	No Std / No Std	Not applicable. This assessment unit was created for the 2012 cycle by splitting the Squamscott River assessment zone (assessment unit ID = NHEST600030806-01) into two pieces. The parent assessment zone was listed as impaired (5-P) for water clarity to protect eelgrass habitat on the 2010 303d list. The impairment was contingent upon the Estuarine Bioassessments (eelgrass) impairment and therefore not retained on this assessment zone in 2012 because eelgrass has not historically existed in this assessment zone.
Total Nitrogen	5-P / 5-P	The median total nitrogen from 2008 through 2013 was 1,056 ug/L (n=10). New Hampshire is no longer comparing ambient total nitrogen data to the total nitrogen numeric indicators used in the 2012 assessment as translators for the narrative water quality criteria. This assessment zone experiences frequent dissolved oxygen concentrations well below 5 mg/L and daily average saturation below 75 percent. During some periods this assessment zone also demonstrates super saturation including multiple days in 2011 experiencing dissolved oxygen saturation over 125 percent and up to 169 percent in grab samples. The 90th percentile for chlorophyll-a concentration was 136 (n=39) from 2008 through 2013 including one sample measured at 234 ug/L. Many of the classic indicators of nutrient eutrophication are present in this assessment zone. As such, the impairment for nitrogen has been retained.


Chlorophyll-a
SQUAMSCOTT RIVER SOUTH
ug Chl-a / L
250
200
150
100
50
0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Chl-a Ind. (90th percentile)
"Current" Line for 2014
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN


Dissolved Oxygen Concentration
SQUAMSCOTT RIVER SOUTH
Dissolved Oxygen, mg / L
14
12
10
8
6
4
2
0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2014
DO-PPM-24HR-MIN-CP
DO-PPM-GRAB-CP
DO-PPM-GRAB-NCP


Dissolved Oxygen Percent Saturation
SQUAMSCOTT RIVER SOUTH
Dissolved Oxygen, Percent Saturation
160
140
120
100
80
60
40
20
0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2014
DO-PERC-24H-MEAN-CP
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP


Light Attenuation
SQUAMSCOTT RIVER SOUTH
Kd 1 / m (PAR) (lower is better)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Survival Min. Ind. (median)
"Current" Line for 2014
LIGHT ATTENUATION COEFFICIENT

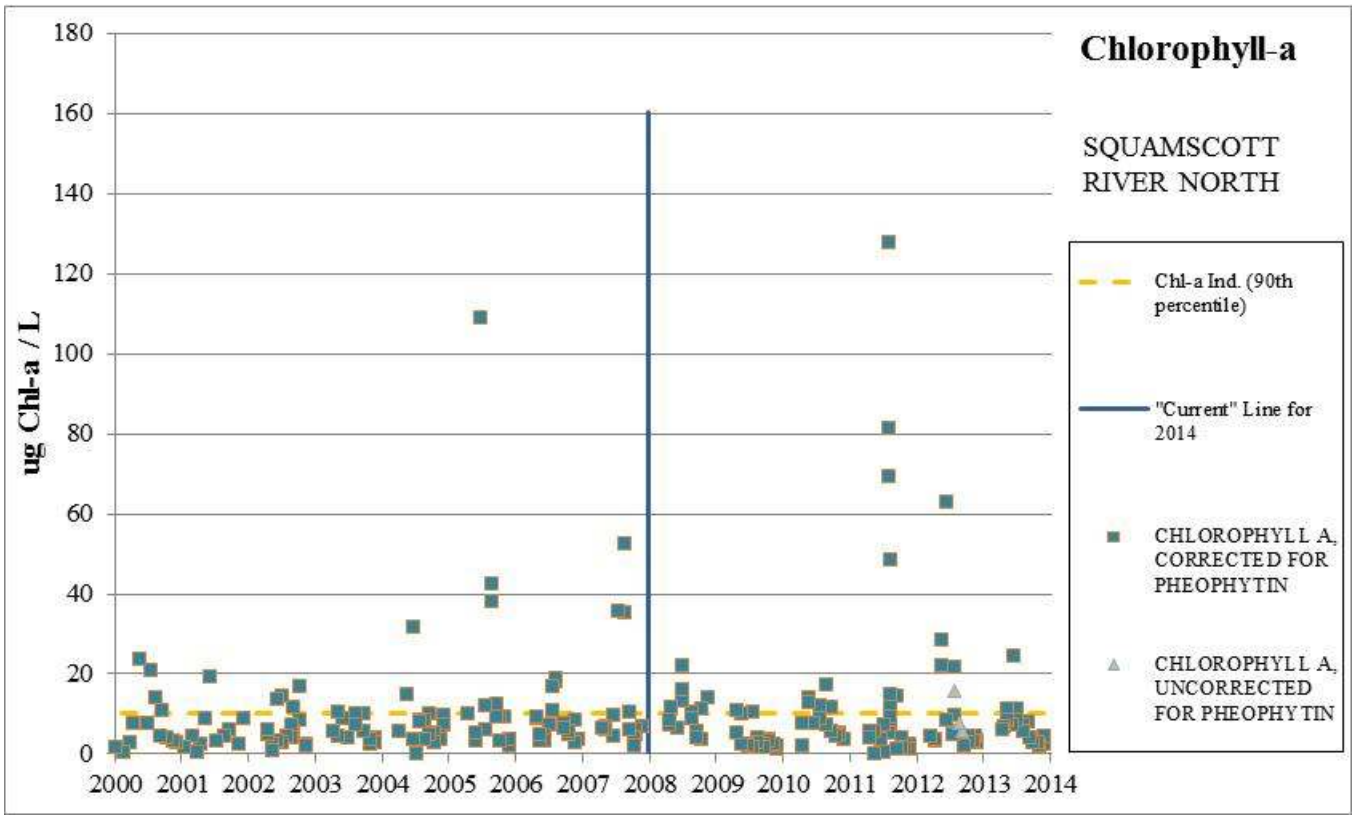


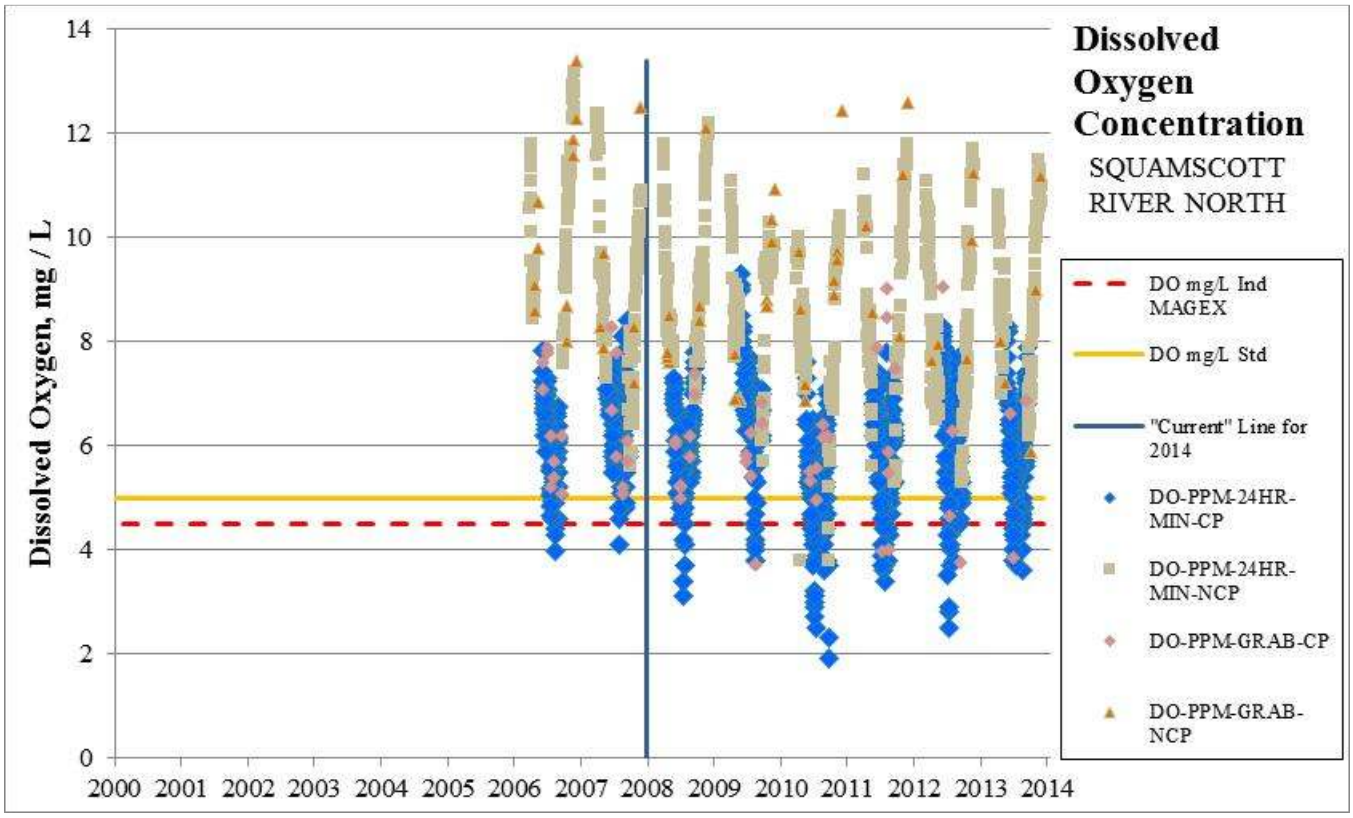
Squamscott River - South Assessment Zone (January 1, 2008 to November 7, 2014)	**Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	39	4.9	17.1	**136.1**	233.8
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	-	-	-	-	-
CHLOROPHYLL A, combined	39	4.9	17.1	136.1	233.8
DO-PERC-24H-MEAN-CP	110	48.2	76.6	85.0	103.6
DO-PERC-24H-MEAN-NCP	-	-	-	-	-
DO-PERC-2TIDE-GRAB-CP	15	65.2	94.6	140.1	142.1
DO-PERC-2TIDE-GRAB-NCP	4	90.2	92.9	-	98.7
DO-PPM-24HR-MIN-CP	109	2.6	5.5	6.7	7.4
DO-PPM-24HR-MIN-NCP	-	-	-	-	-
DO-PPM-GRAB-CP	17	4.2	7.2	9.1	9.3
DO-PPM-GRAB-NCP	6	8.6	9.4	-	10.9
LIGHT ATTENUATION COEFFICIENT	19	2.035	**2.570**	3.600	3.830
TURBIDITY	86	12.0	78.3	1,903.5	7,904.0
Day Ave of TN	10	922	**1,056**	1,180	1,182
Day Ave of TDN	10	176	489	779	782
Day Ave of DIN (NH3 + NO2/3)	10	18	302	493	499
Day Ave of NH3	10	3	115	250	254
Day Ave of PON	5	171	298	-	521
Day Ave of NO2/3	10	9	155	208	210

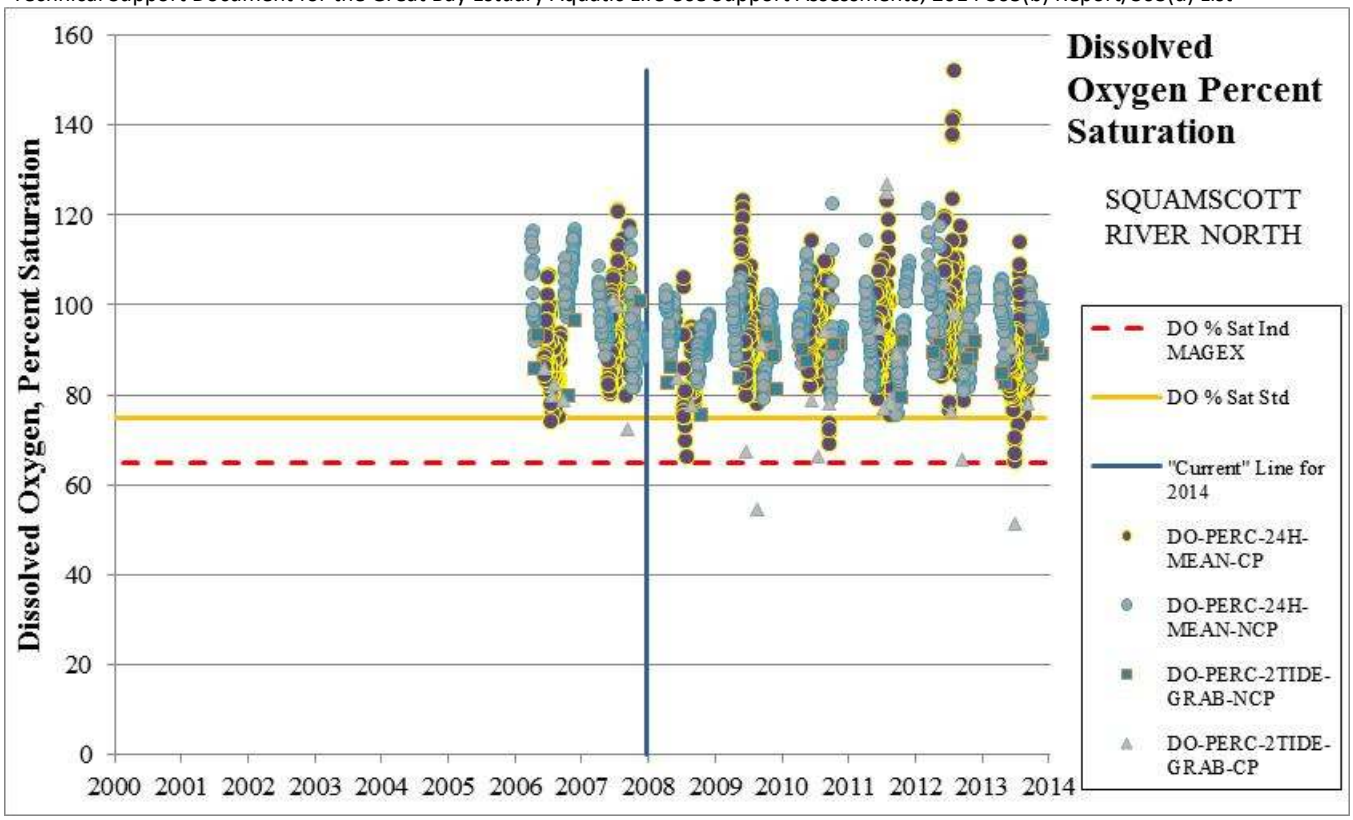
Assessment Zone = SQUAMSCOTT RIVER NORTH

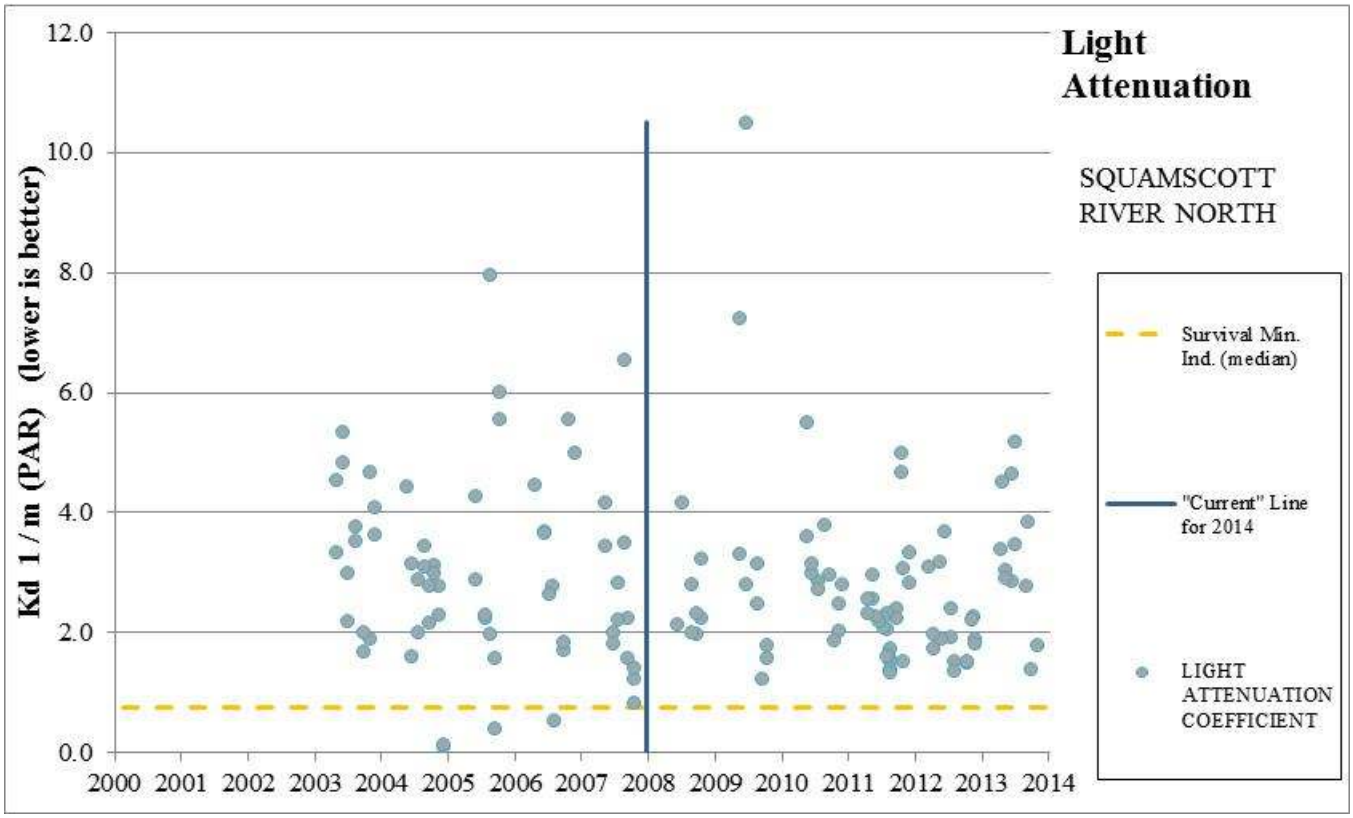
(NHEST600030806-01-02)

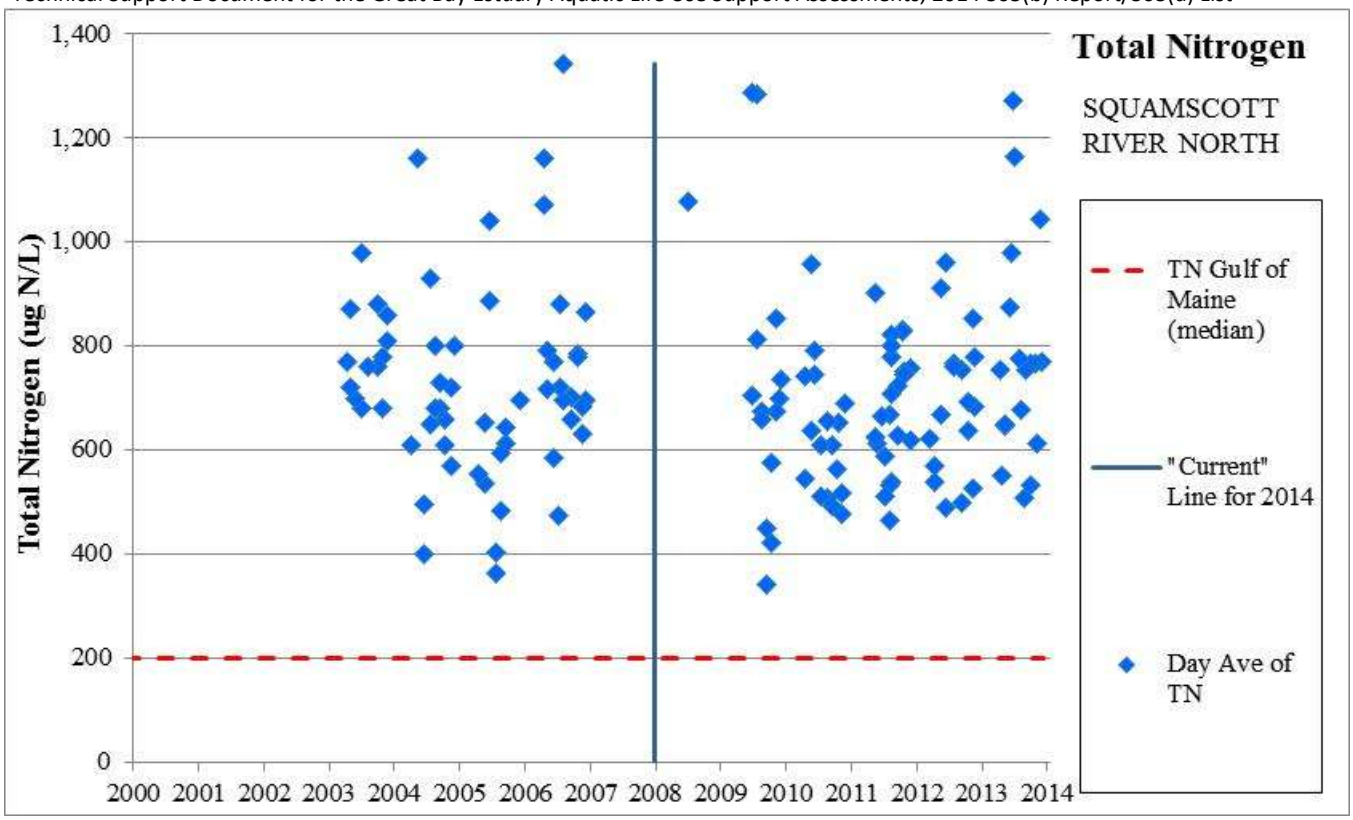
Indicator	Aquatic Life Use Category 2012 / 2014	2014
Chlorophyll-a	5-P / 5-P	Chlorophyll-a data has been collected in the Squamscott River North assessment zone every year since 2008. The 90th percentile for chlorophyll-a, is 16.8 ug/L (n=115) which includes multiple readings over 50 ug/L. The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L. As noted in the March 20, 2012 HydroQual report, "…such elevated algal levels probably contribute to increased SOD which will contribute to lower DO when algal levels are low…" (HydroQual, March 20, 2012). Additionally, there are still frequent dissolved oxygen concentration criteria exceedences.
Dissolved Oxygen (mg/L)	5-P / 5-P	Dissolved oxygen concentration measurements in this assessment zone fall below the 5 mg/L criteria every year. Because a portion of those measurements fall below 4 mg/L each year, and in some years below 3 mg/L, this impairment is considered severe.
Dissolved Oxygen (% Saturation)	2-M / 5-M	Following the 10% method listed in the 2014 CALM this parameter would be categorized as 2-M. Part of the concept behind the 10% rule was to address random errors within the meter measurement accuracy, thereby limiting accidental impairments. The magnitude of exceedence criteria was layered into the assessment process to address major exceedences and exceedences beyond all normal measurement errors. In the case of this assessment zone there are 851 station/days of DO readings during the critical summer period. Three of the last six years of data show criteria exceedences on multiple days, which demonstrates that this phenomenon is not limited to a single summer. It is clear that it is common in this assessment zone to have 24 hour average dissolved oxygen below 75 percent. While no 24 hour average dissolved oxygen readings fell below the magnitude of exceedence indicator of 65 percent, there were several close values (e.g. 65.4 percent average on July 10, 2013).
Estuarine Bioassessments (eelgrass)	5-P / 5-P	In the 2012 assessment cycle, this assessment zone was listed as impaired for "Estuarine Bioassessments" (i.e. a lack of eelgrass) based on the 1948 survey that indicated that roughly 42 acres of eelgrass were present and despite intensive mapping efforts since 1981, eelgrass has never again been documented in this zone. While the 1948 map is rough enough that we cannot say that precisely 42 acres of eelgrass were present, its presence was clearly documented. Combined with the application of the Eelgrass Site Selection Model (Short, Davis, Kopp, Short, & Burdick, 2002) and a rudimentary suitability evaluation of temperature and salinity leads one to conclude that eelgrass should be present. Taken in totality, there is insufficient evidence to remove the 2012 "Estuarine Bioassessment" impairment. As such, the impairment for "Estuarine Bioassessments" and "Water Clarity (Light Attenuation Coefficient)" have been retained on the 2014 final 303(d).
Water Clarity (Light Attenuation Coefficient)	5-P / 5-P	Median=2.415 m^-1 (n=82). For an eelgrass restoration depth of 2 m, the light attenuation coefficient threshold is 0.75 m^-1. Therefore, the impaired (5-M) listing from the 2012 303d list has been retained.
Total Nitrogen	5-P / 5-P	The median total nitrogen from 2008 through 2013 was 676 ug/L (n=89). New Hampshire is no longer comparing ambient total nitrogen data to the total nitrogen numeric indicators used in the 2012 assessment as translators for the narrative water quality criteria. This assessment zone continues to experience frequently dissolved oxygen concentrations well below 5 mg/L and periodic readings below the 24 hour average 75 percent saturation criteria. During some periods this assessment zone also demonstrates severe super saturation including multiple days in 2012 experiencing 24 hour average dissolved oxygen saturation in excess of 125 percent and as high as 152 percent. The chlorophyll-a concentration 90th percentile was 16.8 (n=115) from 2008 through 2013 and multiple samples were over 50 ug/L including one sample measured at 128 ug/L. As noted in the March 20, 2012 HydroQual report, "The substantial reduction in the concentration of algal cells that settle to the river bottom and contribute to river SOD as a consequence of a reduction in the Exeter WWTP effluent nitrogen will increase Squamscott River minimum DO levels and possibly attain the DO standard." (HydroQual, March 20, 2012). Many of the classic indicators of nutrient eutrophication are present in this assessment zone. As such, the impairment for nitrogen has been retained.


Chlorophyll-a
SQUAMSCOTT RIVER NORTH
ug Chl-a / L
180
160
140
120
100
80
60
40
20
0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Chl-a Ind. (90th percentile)
"Current" Line for 2014
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN


Dissolved Oxygen Concentration
SQUAMSCOTT RIVER NORTH
Dissolved Oxygen, mg / L
14
12
10
8
6
4
2
0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2014
DO-PPM-24HR-MIN-CP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP
DO-PPM-GRAB-NCP


Dissolved Oxygen Percent Saturation
SQUAMSCOTT RIVER NORTH
Dissolved Oxygen, Percent Saturation
160
140
120
100
80
60
40
20
0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2014
DO-PERC-24H-MEAN-CP
DO-PERC-24H-MEAN-NCP
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP


Light Attenuation
SQUAMSCOTT RIVER NORTH
Kd 1 / m (PAR) (lower is better)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Survival Min. Ind. (median)
"Current" Line for 2014
LIGHT ATTENUATION COEFFICIENT

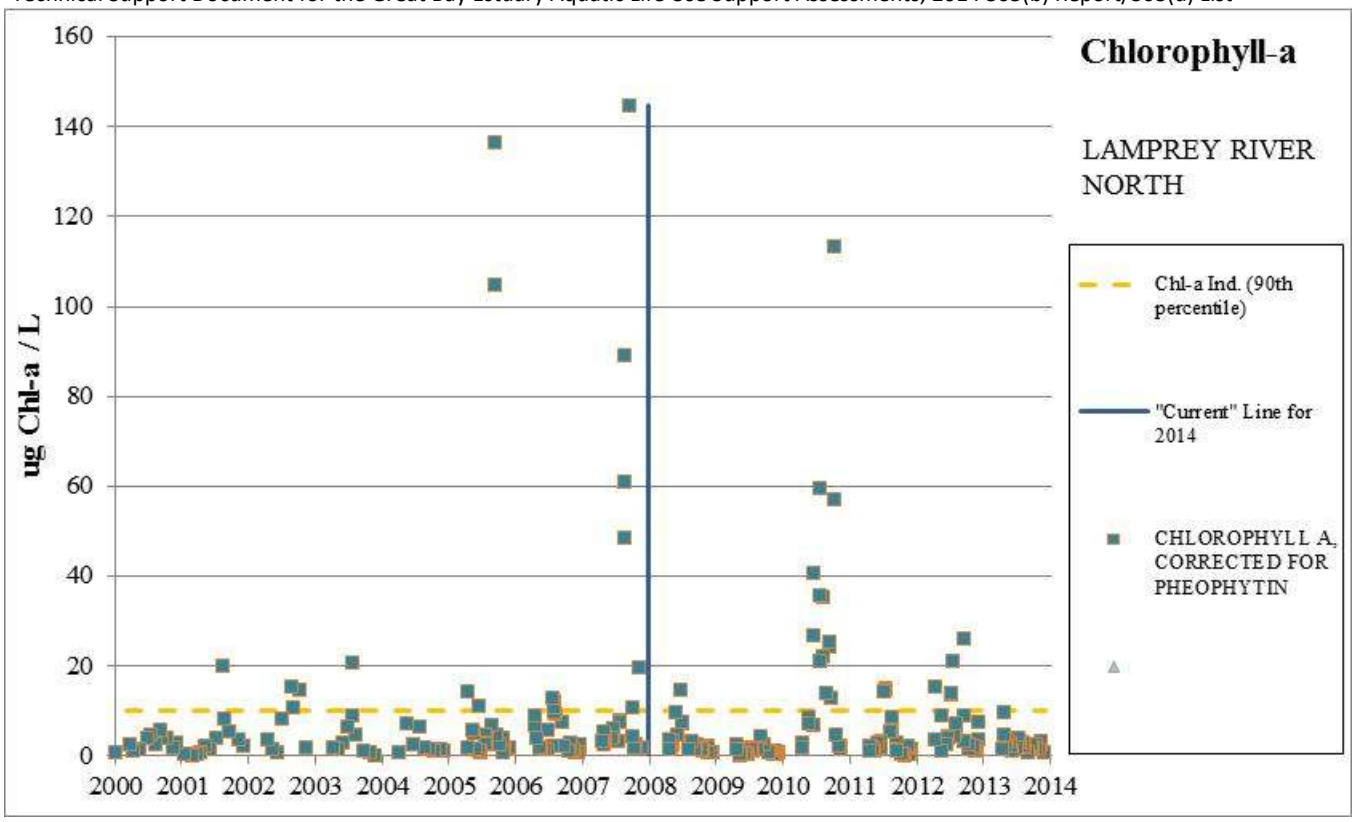


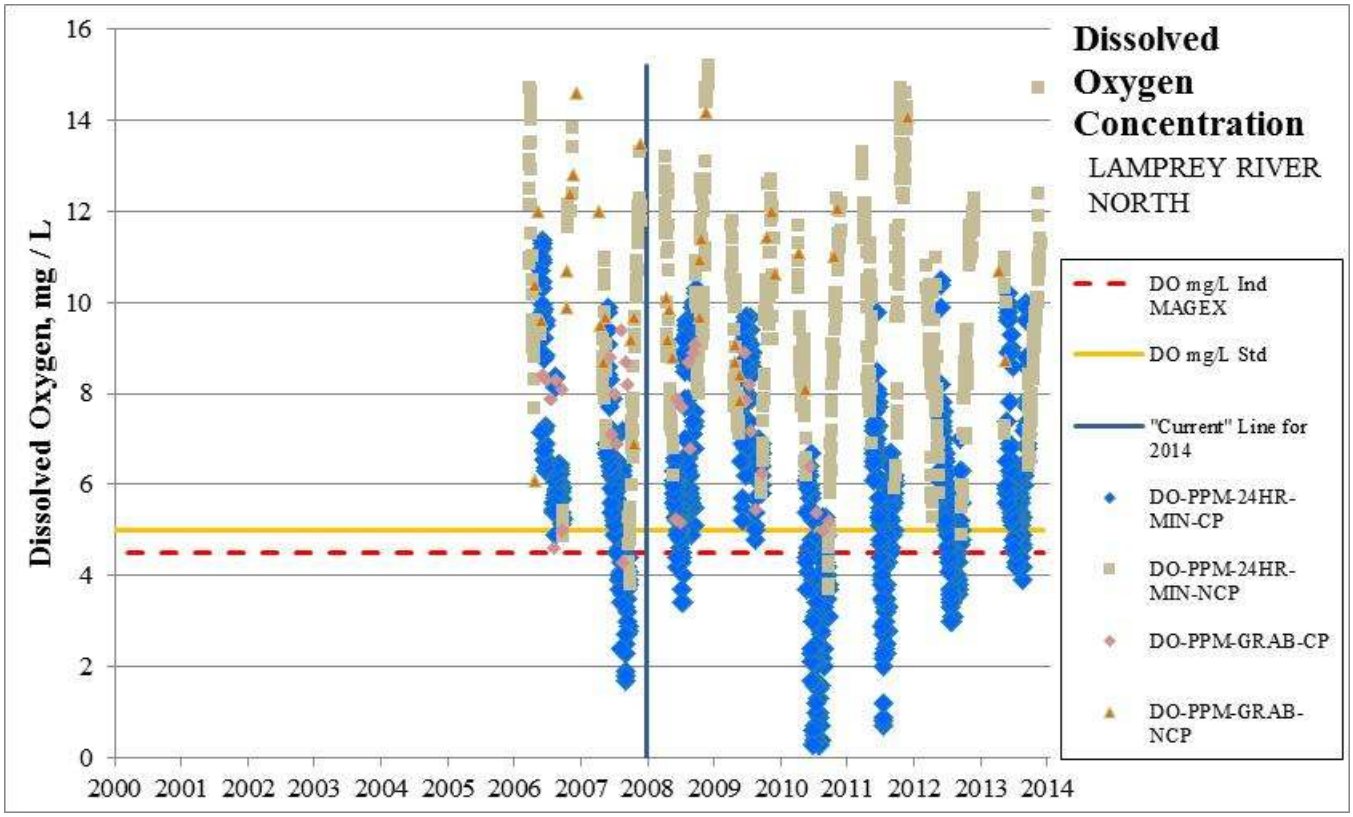
Squamscott River - North Assessment Zone (January 1, 2008 to November 7, 2014)	**Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	112	0.4	5.8	**17.1**	128.0
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	3	5.4	7.5	-	15.6
CHLOROPHYLL A, combined	115	0.4	5.9	16.8	128.0
DO-PERC-24H-MEAN-CP	640	65.4	91.7	105.0	152.0
DO-PERC-24H-MEAN-NCP	706	75.7	94.2	103.9	122.6
DO-PERC-2TIDE-GRAB-CP	23	51.5	78.9	117.0	127.0
DO-PERC-2TIDE-GRAB-NCP	23	75.6	89.0	92.2	93.1
DO-PPM-24HR-MIN-CP	712	1.9	6.0	7.4	9.3
DO-PPM-24HR-MIN-NCP	724	3.8	8.8	10.8	12.2
DO-PPM-GRAB-CP	40	3.7	6.0	7.8	9.1
DO-PPM-GRAB-NCP	41	5.9	8.7	11.2	12.6
LIGHT ATTENUATION COEFFICIENT	82	1.245	**2.415**	4.421	10.520
TURBIDITY	1,339	7.0	89.0	564.0	1,906.0
Day Ave of TN	89	340	**676**	956	1,288
Day Ave of TDN	111	180	531	691	948
Day Ave of DIN (NH3 + NO2/3)	110	10	283	539	1,022
Day Ave of NH3	110	3	146	300	560
Day Ave of PON	3	177	243	-	293
Day Ave of NO2/3	112	9	131	206	408

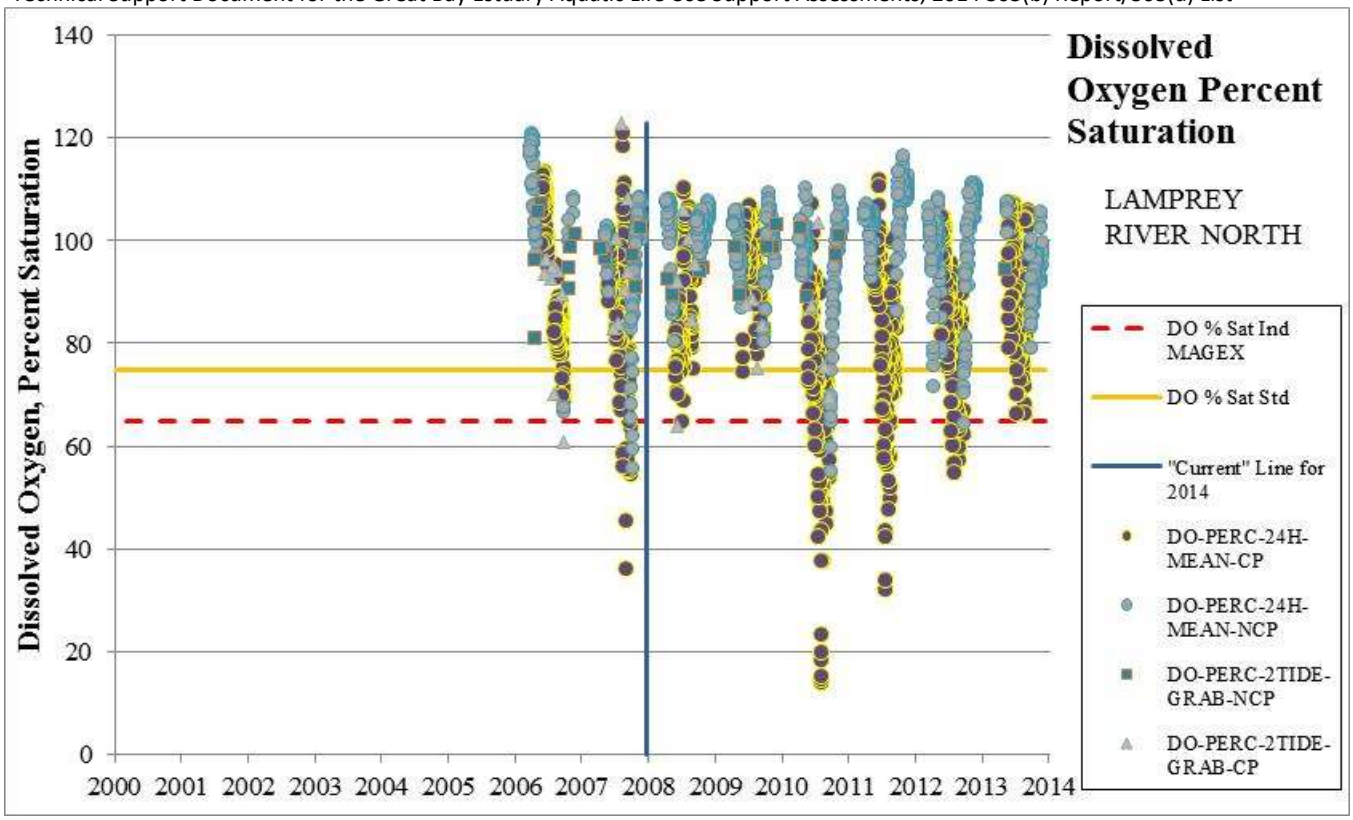
Assessment Zone = LAMPREY RIVER NORTH

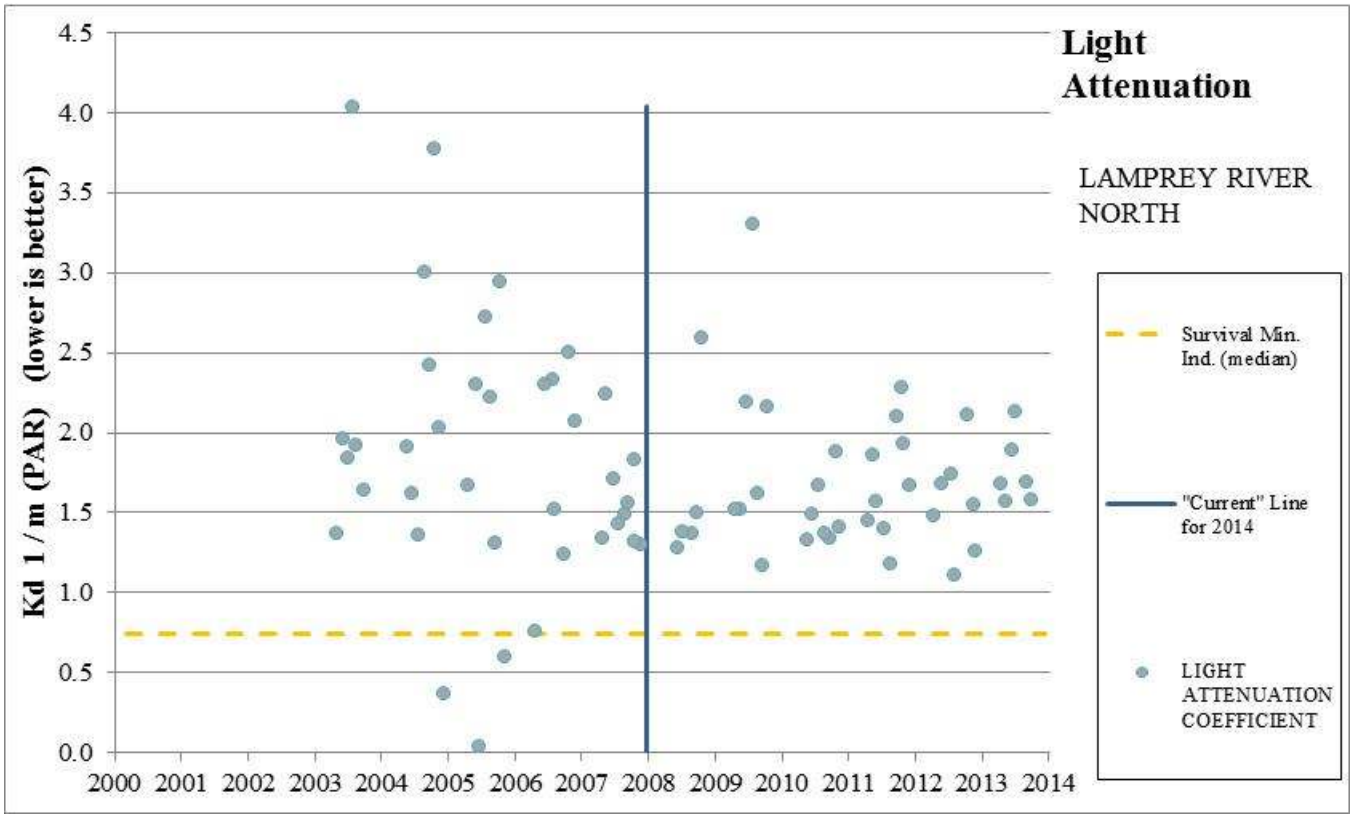
(NHEST600030709-01-01)

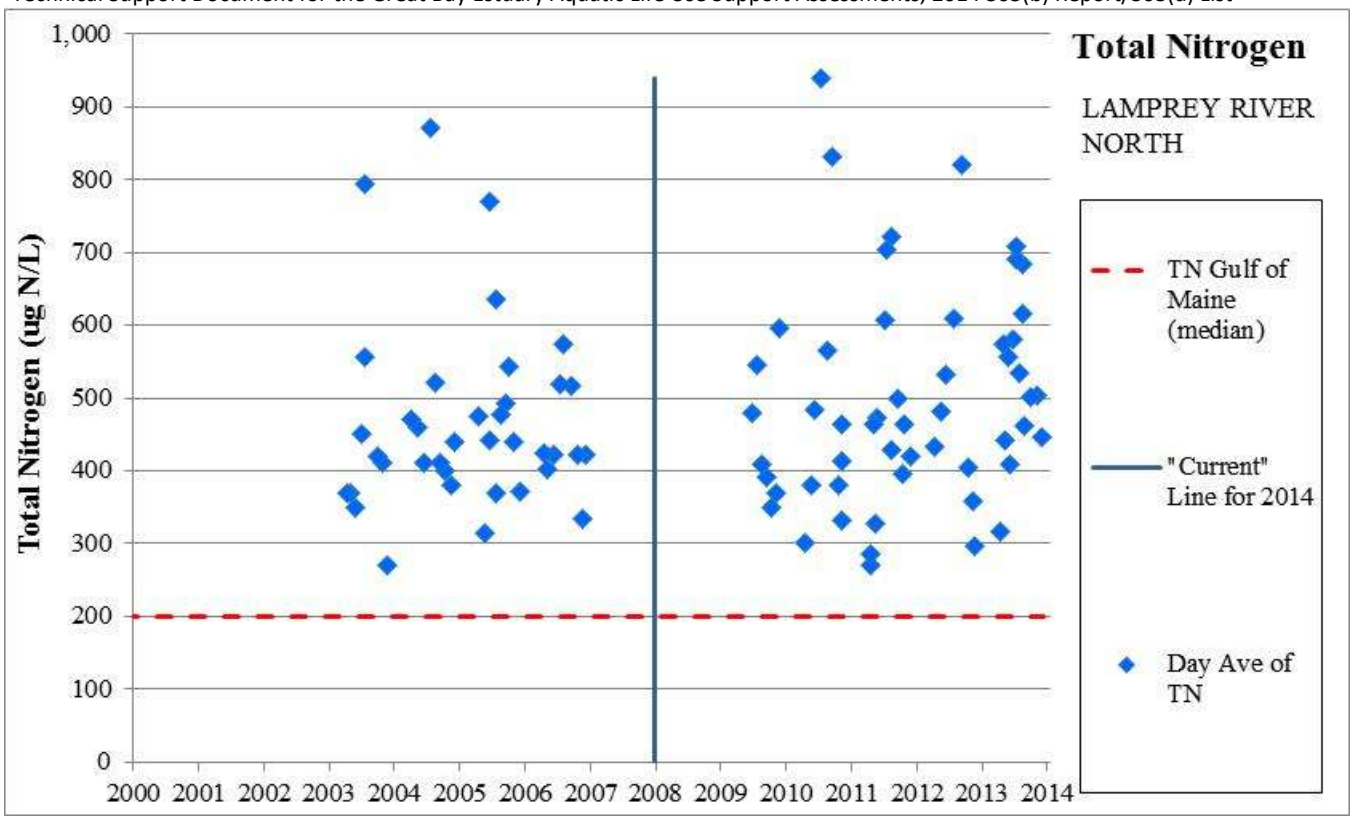
Indicator	Aquatic Life Use Category 2012 / 2014	2014
Chlorophyll-a	5-M / 5-M	The calculated 90th percentile chlorophyll-a in this assessment zone is 15 ug/L (n = 153) and the zone had a maximum reading of 114 ug/L. The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L. Additionally, there are still frequent dissolved oxygen concentration and percent saturation criteria exceedences
Dissolved Oxygen (mg/L)	5-P / 5-P	Dissolved oxygen concentration measurements in this assessment zone fall below the 5 mg/L criteria every year. Because a portion of those measurements fall below 4 mg/L each year, and in some years below 1 mg/L, this impairment is considered severe.
Dissolved Oxygen (% Saturation)	5-M / 5-P	Dissolved oxygen 24 hour average percent saturation measurements in this assessment zone fall below the 75 percent criteria every year. Because a portion of those measurements fall below 65 percent each year, and in some years below 20 percent, this impairment is considered severe.
Estuarine Bioassessments (eelgrass)	No Std / No Std	Not applicable. Eelgrass habitat has not historically existed in this assessment zone.
Water Clarity (Light Attenuation Coefficient)	No Std / No Std	Not applicable. The water clarity has not been assessed because eelgrass has not historically existed in this assessment zone.
Total Nitrogen	5-M / 5-M	The median total nitrogen from 2008 through 2013 was 464 ug/L (n=53). New Hampshire is no longer comparing ambient total nitrogen data to the total nitrogen numeric indicators used in the 2012 assessment as translators for the narrative water quality criteria. This assessment zone experiences frequent dissolved oxygen concentrations well below 5 mg/L and daily average saturation below 75 percent. During some periods this assessment zone also demonstrates super saturation including multiple days in 2012 and a few dates in 2011 experiencing dissolved oxygen saturation over 125 percent. The chlorophyll-a concentration 90th percentile was 15 (n=153) from 2008 through 2013 and several samples were over 50 ug/L including one sample measured at 114 ug/L. Many of the classic indicators of nutrient eutrophication are present in this assessment zone. As such, the impairment for nitrogen has been retained.


Chlorophyll-a
LAMPREY RIVER NORTH
ug Chl-a / L
0
20
40
60
80
100
120
140
160
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Chl-a Ind. (90th percentile)
"Current" Line for 2014
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN


Dissolved Oxygen Concentration
LAMPREY RIVER NORTH
Dissolved Oxygen, mg / L
0
2
4
6
8
10
12
14
16
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2014
DO-PPM-24HR-MIN-CP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP
DO-PPM-GRAB-NCP


Dissolved Oxygen Percent Saturation
LAMPREY RIVER NORTH
Dissolved Oxygen, Percent Saturation
140
120
100
80
60
40
20
0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2014
DO-PERC-24H-MEAN-CP
DO-PERC-24H-MEAN-NCP
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP


Light Attenuation
LAMPREY RIVER NORTH
Kd 1 / m (PAR) (lower is better)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Survival Min. Ind. (median)
"Current" Line for 2014
LIGHT ATTENUATION COEFFICIENT



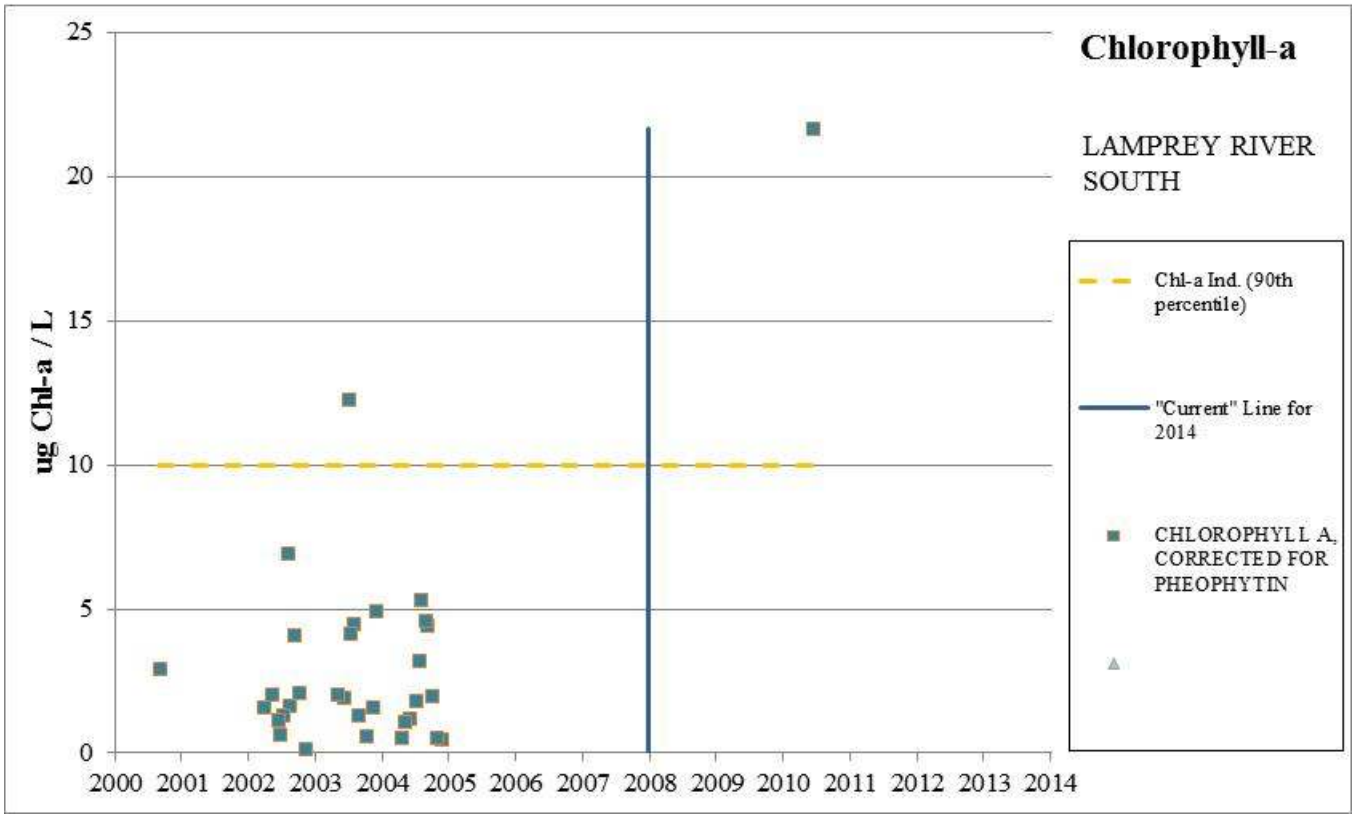
Lamprey River - North Assessment Zone (January 1, 2008 to November 7, 2014)	**Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	153	0.1	2.4	**15.0**	113.5
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	-	-	-	-	-
CHLOROPHYLL A, combined	153	0.1	2.4	15.0	113.5
DO-PERC-24H-MEAN-CP	708	14.1	85.7	104.0	111.9
DO-PERC-24H-MEAN-NCP	660	55.2	101.7	108.4	116.6
DO-PERC-2TIDE-GRAB-CP	14	63.9	87.4	104.7	106.0
DO-PERC-2TIDE-GRAB-NCP	14	89.2	96.1	102.9	103.2
DO-PPM-24HR-MIN-CP	707	0.3	5.7	8.7	10.5
DO-PPM-24HR-MIN-NCP	666	3.7	9.7	12.6	15.2
DO-PPM-GRAB-CP	18	5.0	7.0	8.9	9.1
DO-PPM-GRAB-NCP	22	7.8	10.4	13.5	14.2
LIGHT ATTENUATION COEFFICIENT	41	1.120	**1.585**	2.203	3.315
TURBIDITY	1,393	0.0	13.0	166.4	1,555.0
Day Ave of TN	53	271	**464**	707	939
Day Ave of TDN	155	233	441	645	823
Day Ave of DIN (NH3 + NO2/3)	155	34	274	685	1,166
Day Ave of NH3	155	3	151	376	839
Day Ave of PON	-	-	-	-	-
Day Ave of NO2/3	155	21	117	219	410

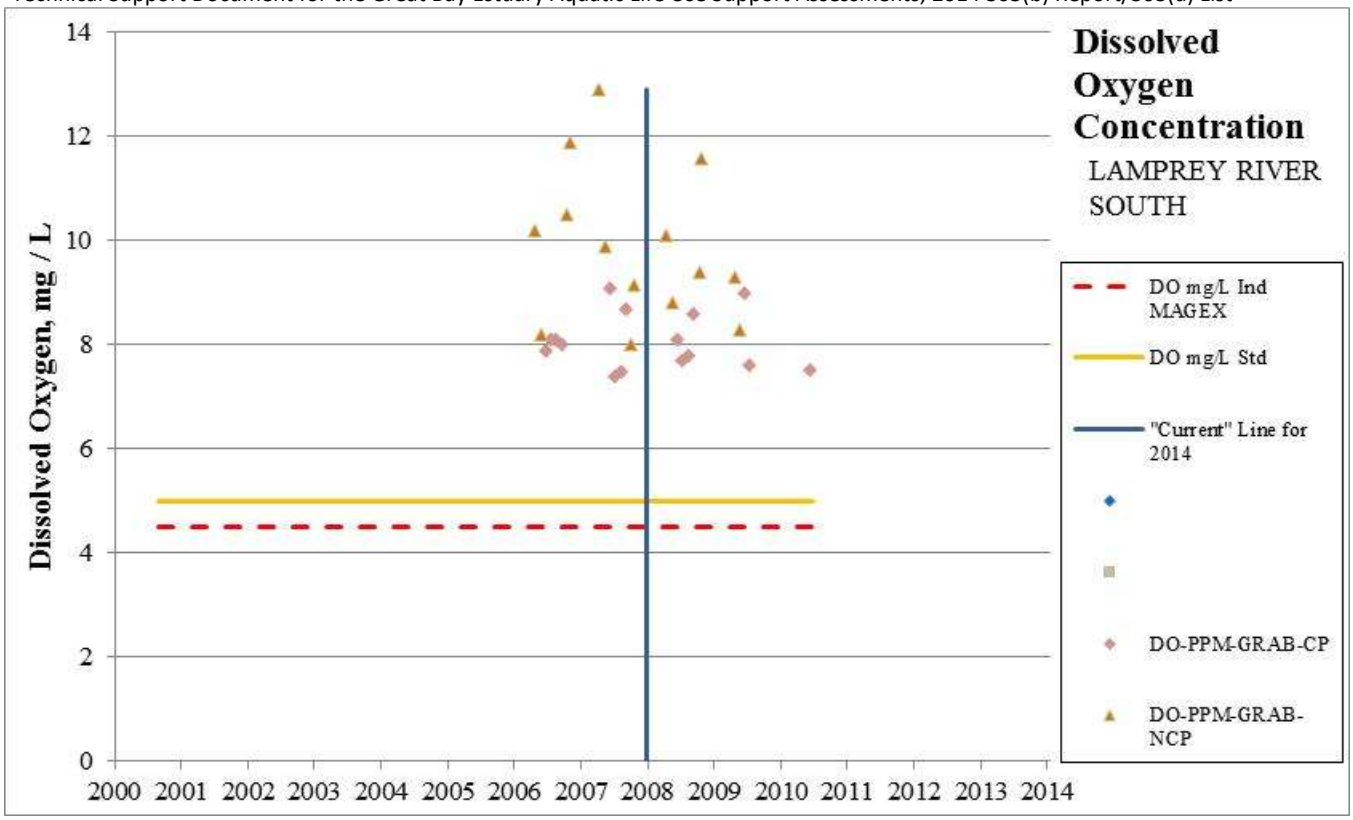
Assessment Zone = LAMPREY RIVER SOUTH

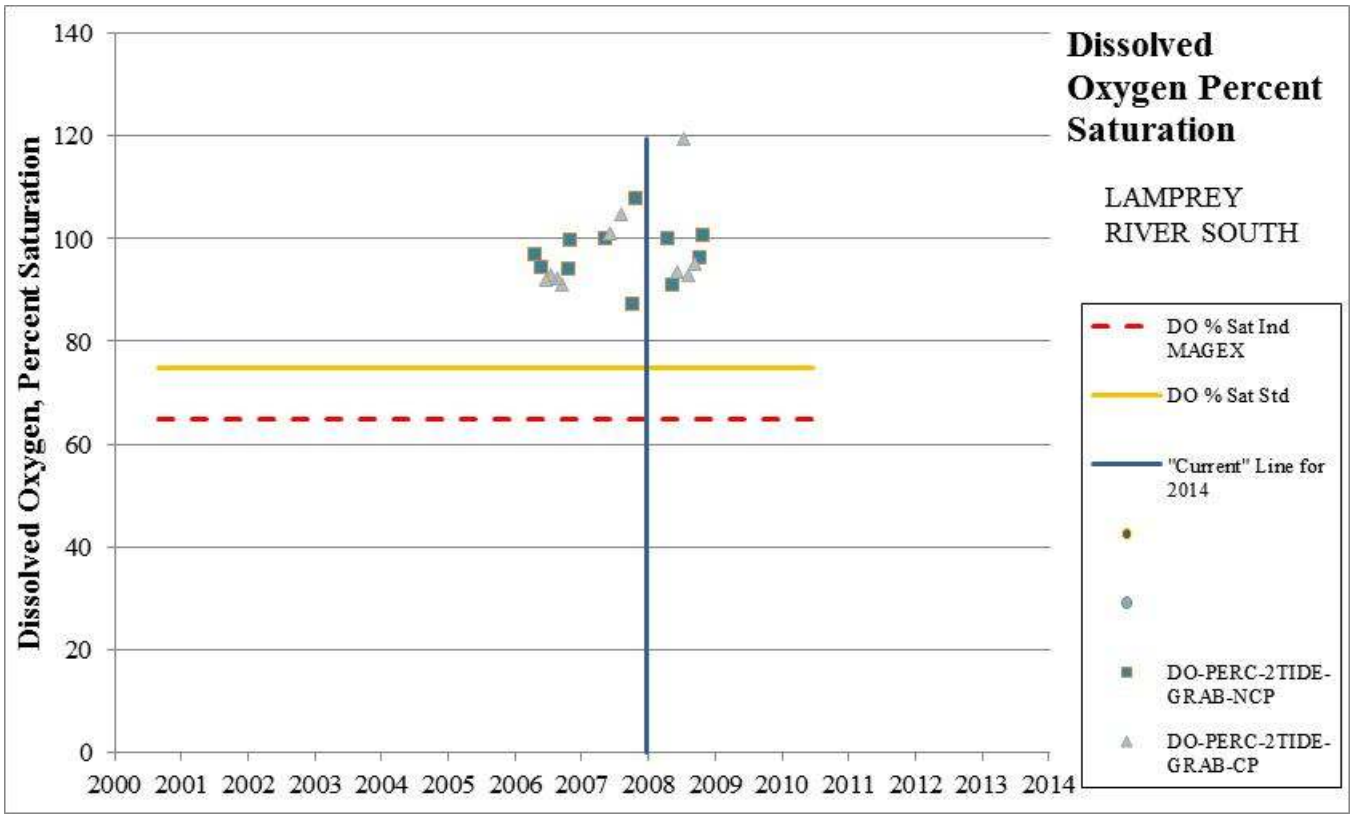
(NHEST600030709-01-02)

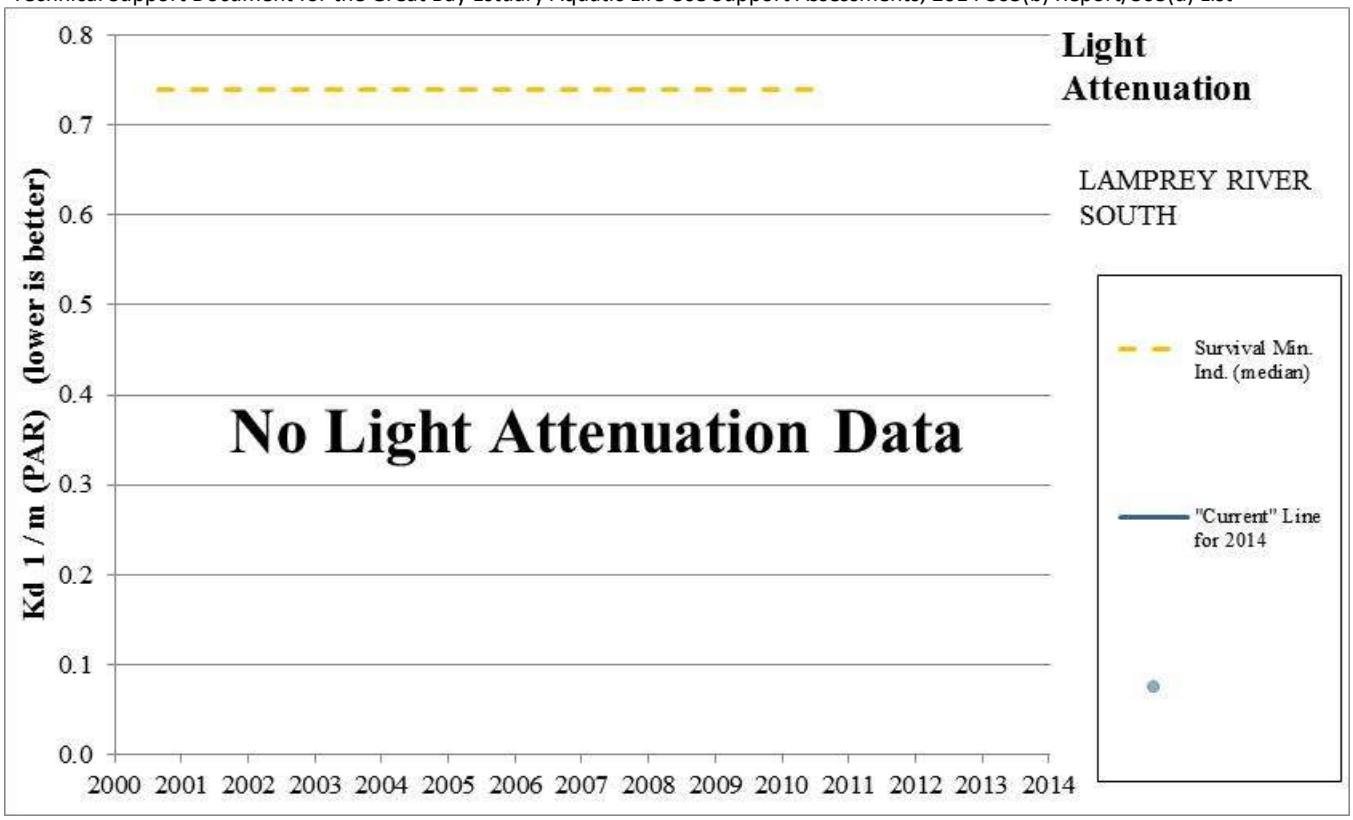
Indicator	Aquatic Life Use Category 2012 / 2014	2014
Chlorophyll-a	5-M / 5-M	The calculated 90th percentile chlorophyll-a in this assessment zone cannot be calculated due to the presence of only one measured value since 2008 (22 ug/L). The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L. This assessment unit was created in 2012 as a child of assessment unit NHEST600030709-01, which was impaired for chlorophyll-a and total nitrogen on the 2010 303d list. The parent assessment unit was split for the 2012 assessments. There were insufficient data for a new assessment in 2012. The available data for chlorophyll-a indicates concentrations greater than the criteria, although only one sample exists (22 ug/L). Furthermore, the adjacent upstream assessment zone has a chlorophyll-a median of 15 ug/L (n = 153) and a maximum reading of 114 ug/L. The adjacent downstream assessment zone has chlorophyll-a median of 8.9 ug/L (n = 249). Therefore, the 2012 impairment category of 5-M has been retained.
Dissolved Oxygen (mg/L)	2-G / 2-G	This assessment zone has only grab sample measurements for dissolved oxygen concentration and those measurements were only collected up through 2009. That available data indicates that this assessment zone meets the dissolved oxygen criteria.
Dissolved Oxygen (% Saturation)	2-G / 3-PAS	This assessment zone has only grab sample measurements to approximate the dissolved oxygen 24 hour average percent saturation and those measurements were only collected up through 2008. Further, only 4 samples exist during the summer period. That limited available data suggests that this assessment zone meets the dissolved oxygen criteria.
Estuarine Bioassessments (eelgrass)	5-P / 5-P	The historical extent of eelgrass in this assessment zone was 53.4 acres from the 1948 dataset. Patches of eelgrass were found in 2003 (2.2 acres) and 2011 (0.5 acres). The median current extent of eelgrass in 2011-2013 is 0 acres, which is a 100% decrease. Since 1990, the trend in eelgrass cover in this assessment zone could not be determined because the eelgrass cover has been zero for most years since 1981. The thresholds for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	5-P / 5-P	The median could not be calculated for the 2008 through 2013 period (n=0) within this assessment zone. For an eelgrass restoration depth of 2 m, the light attenuation coefficient indicator threshold is 0.75 m^-1. This assessment zone historically had eelgrass growing in both the shallows and deeper habitat making the 2m restoration depth a valid target. This assessment unit (zone) was created for the 2012 cycle by splitting the Lamprey River assessment unit (NHEST600030709-01) into two pieces. The parent assessment zone was listed as impaired (5-P) for water clarity based on data from station GRBLR to protect eelgrass habitat on the 2010 303d list. The GRBLR station is roughly 0.5 miles upstream (north) of the Lamprey River North/South split and has a median light attenuation coefficient of 1.585 m^-1 (n=41) for the 2008 through 2013 period. The downstream boundary to the Lamprey River South assessment zone is Great Bay which had a Median=1.180 m^-1 (n=173) for the 2008 through 2013 period. Assessment zones that were impaired in the previous cycle cannot be removed from the 303d list if there are insufficient data to make a new assessment. Given the lack of new site specific data and the measurements upstream and downstream of this assessment zone the impaired (5-P) listing from the 2012 303d list has been retained.
Total Nitrogen	5-P / 5-M	The median total nitrogen from 2008 through 2013 was 1,055 ug/L (n=1). New Hampshire is no longer comparing ambient total nitrogen data to the total nitrogen numeric indicators used in the 2012 assessment as translators for the narrative water quality criteria. From the limited available grab samples (none since 2008) for dissolved oxygen concentration and saturation the site appears to meet the dissolved oxygen criteria. The calculated 90th percentile chlorophyll-a in this assessment zone cannot be calculated due to the presence of only one measured value in since 2008 (22 ug/L). The available data for chlorophyll-a indicates concentrations greater than the criteria, although only one sample exists (22 ug/L).. The eelgrass beds have been eliminated. The median light attenuation coefficient was not calculated due to no samples collected in the 2008 through 2013 period in this assessment zone, however, both the upstream and downstream assessment zones are impaired due

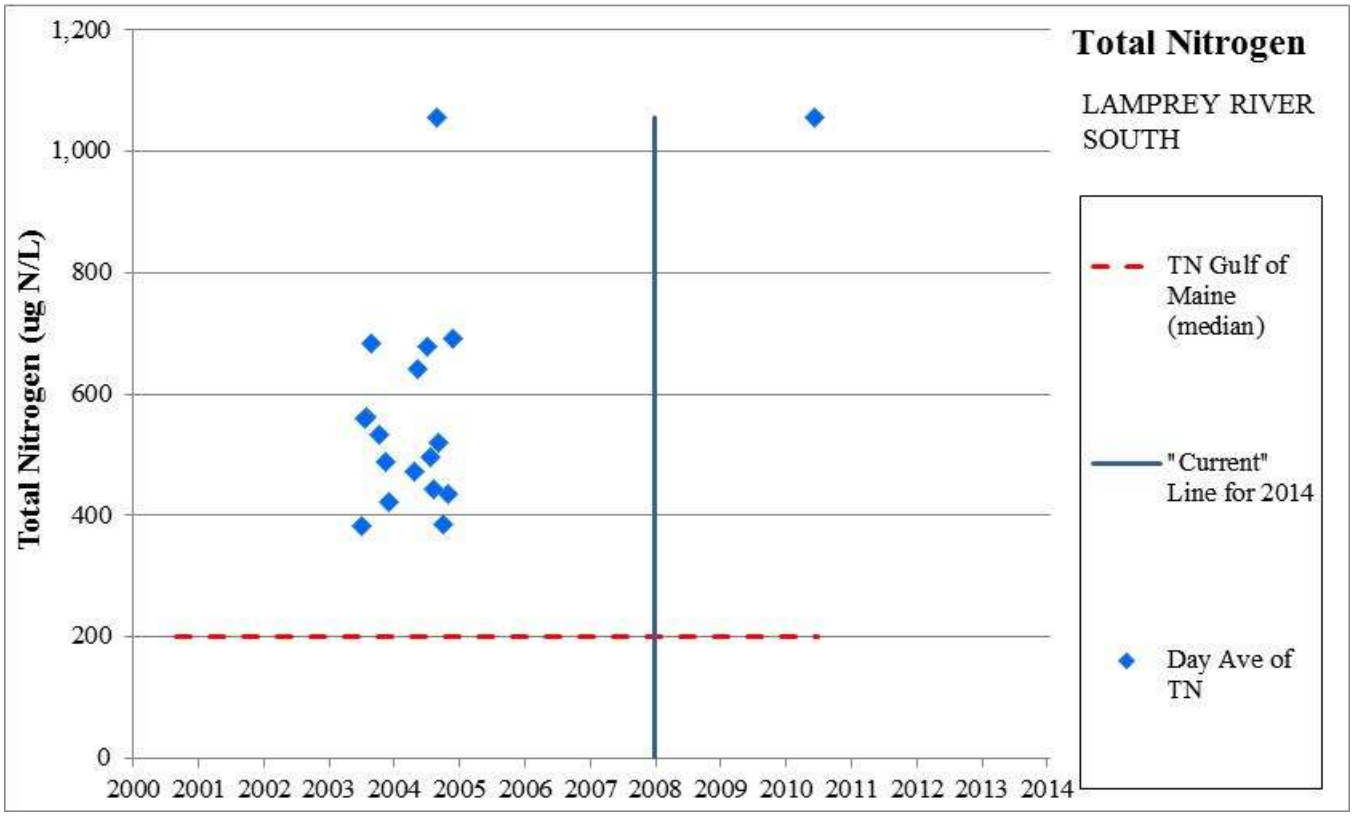
		to the poor light attenuation coefficient. This assessment zone is generally characterized by its lack eutrophication indicator data. What it lacks in local data it makes up for in data from neighboring assessment zones. The upstream Lamprey River North assessment zone has extensive datasets demonstration impairments due to high chlorophyll-a and severely depleted dissolved oxygen. The downstream Great Bay assessment zone has marginally chlorophyll-a and dissolved oxygen due to the severely poor condition coming out of the Squamscott River assessment zone as well as degraded eelgrass, poor light transmittance, and evidence of macroalgae. Taken in totality, there is insufficient evidence to remove the 2012 total nitrogen impairment. As such, the impairment for nitrogen has been retained.




Dissolved Oxygen Concentration
LAMPREY RIVER SOUTH
Dissolved Oxygen, mg / L
0
2
4
6
8
10
12
14
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2014
DO-PPM-GRAB-CP
DO-PPM-GRAB-NCP


Dissolved Oxygen Percent Saturation
LAMPREY RIVER SOUTH
Dissolved Oxygen, Percent Saturation
0
20
40
60
80
100
120
140
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2014
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP


Light Attenuation
LAMPREY RIVER SOUTH
Kd 1 / m (PAR) (lower is better)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
No Light Attenuation Data
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Survival Min. Ind. (median)
"Current" Line for 2014

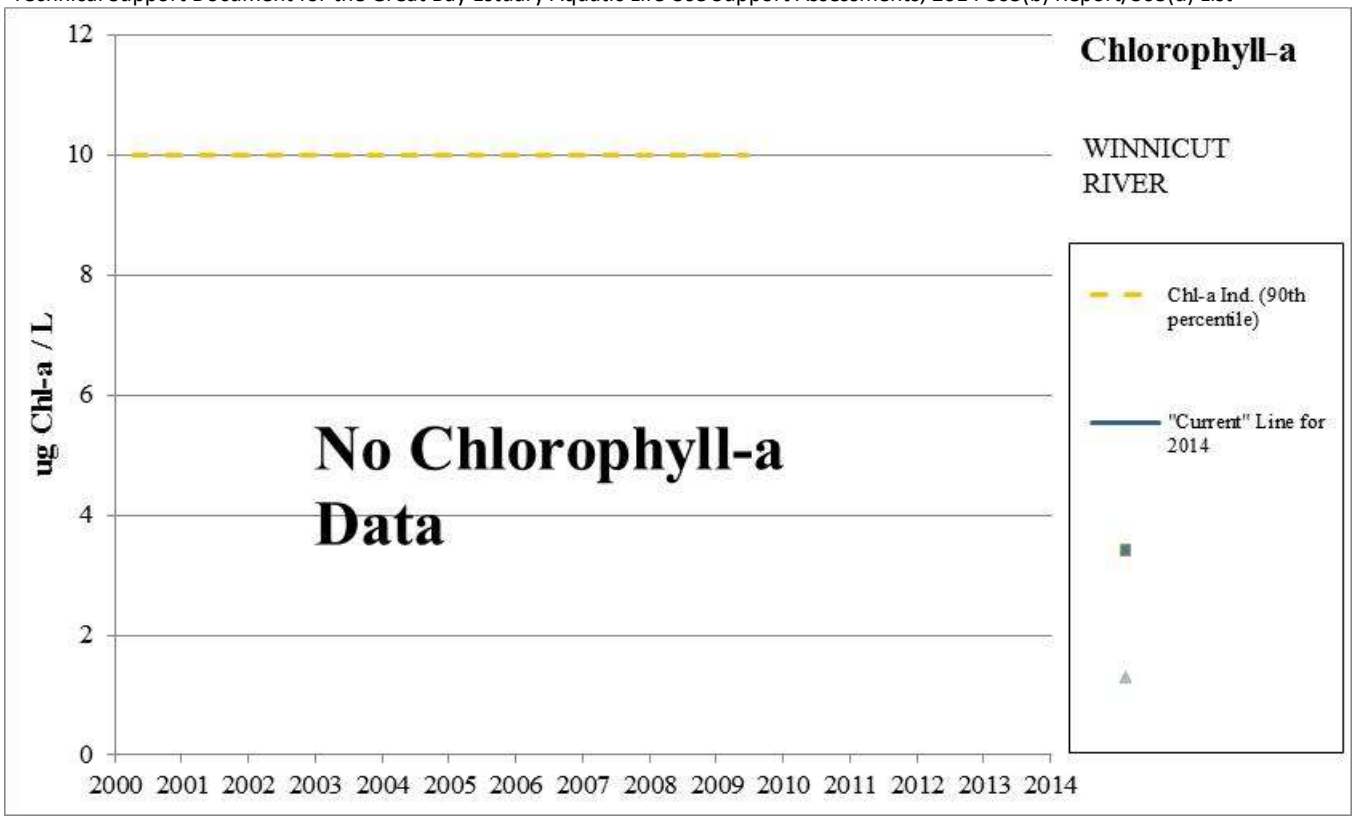

Total Nitrogen
LAMPREY RIVER SOUTH
Total Nitrogen (ug N/L)
1,200
1,000
800
600
400
200
0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
TN Gulf of Maine (median)
"Current" Line for 2014
Day Ave of TN

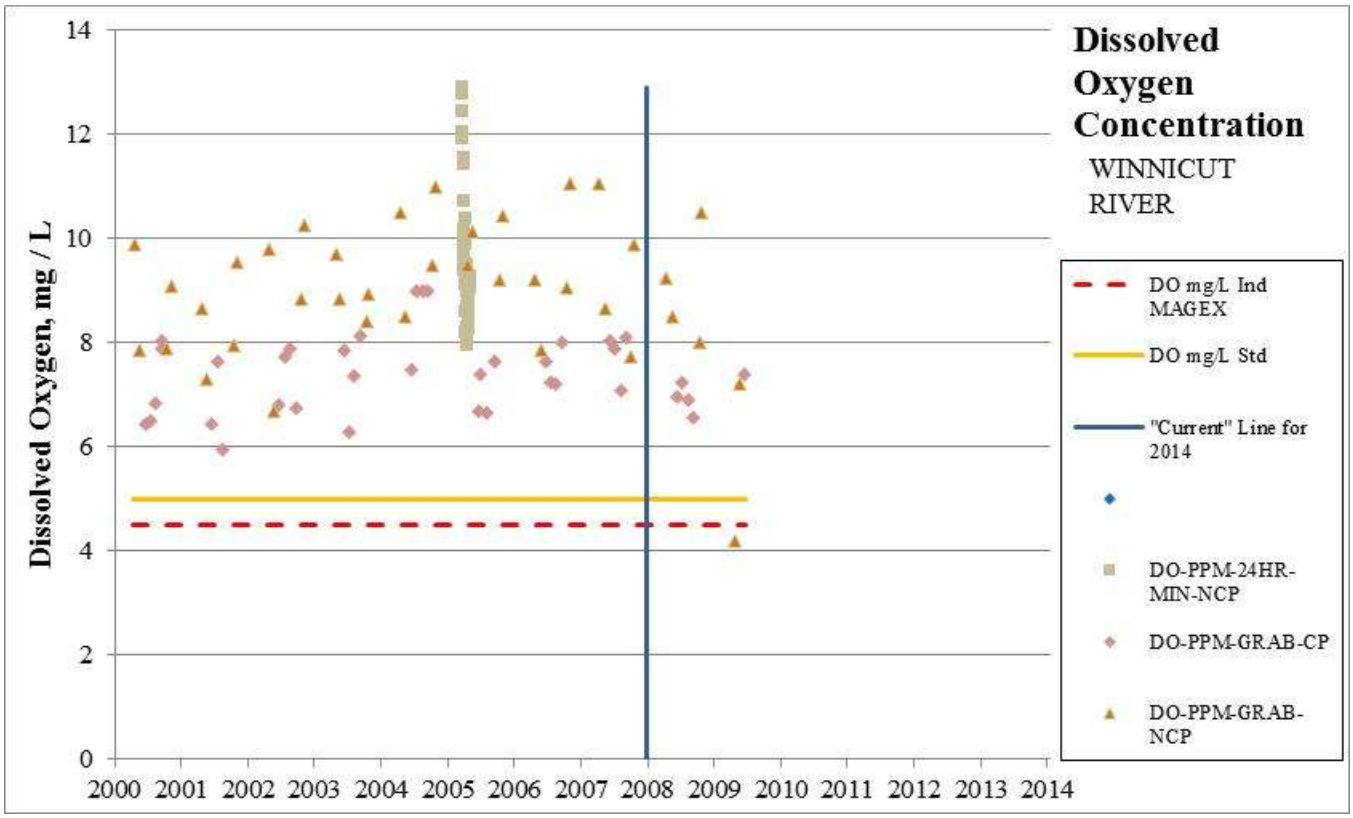
Lamprey River - South Assessment Zone (January 1, 2008 to November 7, 2014)	**Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	1	21.7	21.7	-	21.7
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	-	-	-	-	-
CHLOROPHYLL A, combined	1	21.7	21.7	-	21.7
DO-PERC-24H-MEAN-CP	-	-	-	-	-
DO-PERC-24H-MEAN-NCP	-	-	-	-	-
DO-PERC-2TIDE-GRAB-CP	4	93.1	94.3	-	119.5
DO-PERC-2TIDE-GRAB-NCP	4	91.1	98.3	-	100.7
DO-PPM-24HR-MIN-CP	-	-	-	-	-
DO-PPM-24HR-MIN-NCP	-	-	-	-	-
DO-PPM-GRAB-CP	7	7.5	7.8	-	9.0
DO-PPM-GRAB-NCP	6	8.3	9.4	-	11.6
LIGHT ATTENUATION COEFFICIENT	-	-	-	-	-
TURBIDITY	-	-	-	-	-
Day Ave of TN	1	1,055	**1,055**	-	1,055
Day Ave of TDN	1	631	631	-	631
Day Ave of DIN (NH3 + NO2/3)	1	180	180	-	180
Day Ave of NH3	1	15	15	-	15
Day Ave of PON	1	424	424	-	424
Day Ave of NO2/3	1	165	165	-	165

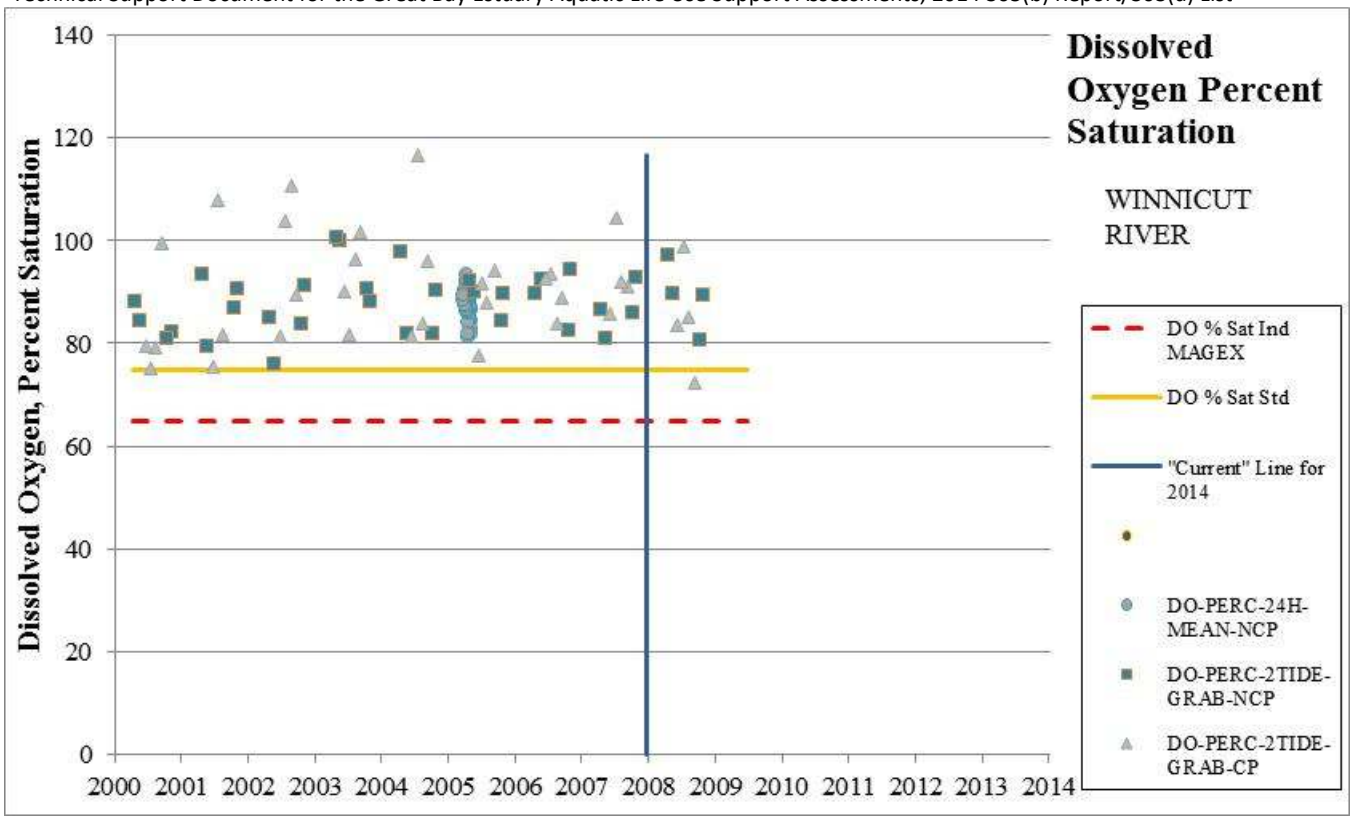
Assessment Zone = WINNICUT RIVER

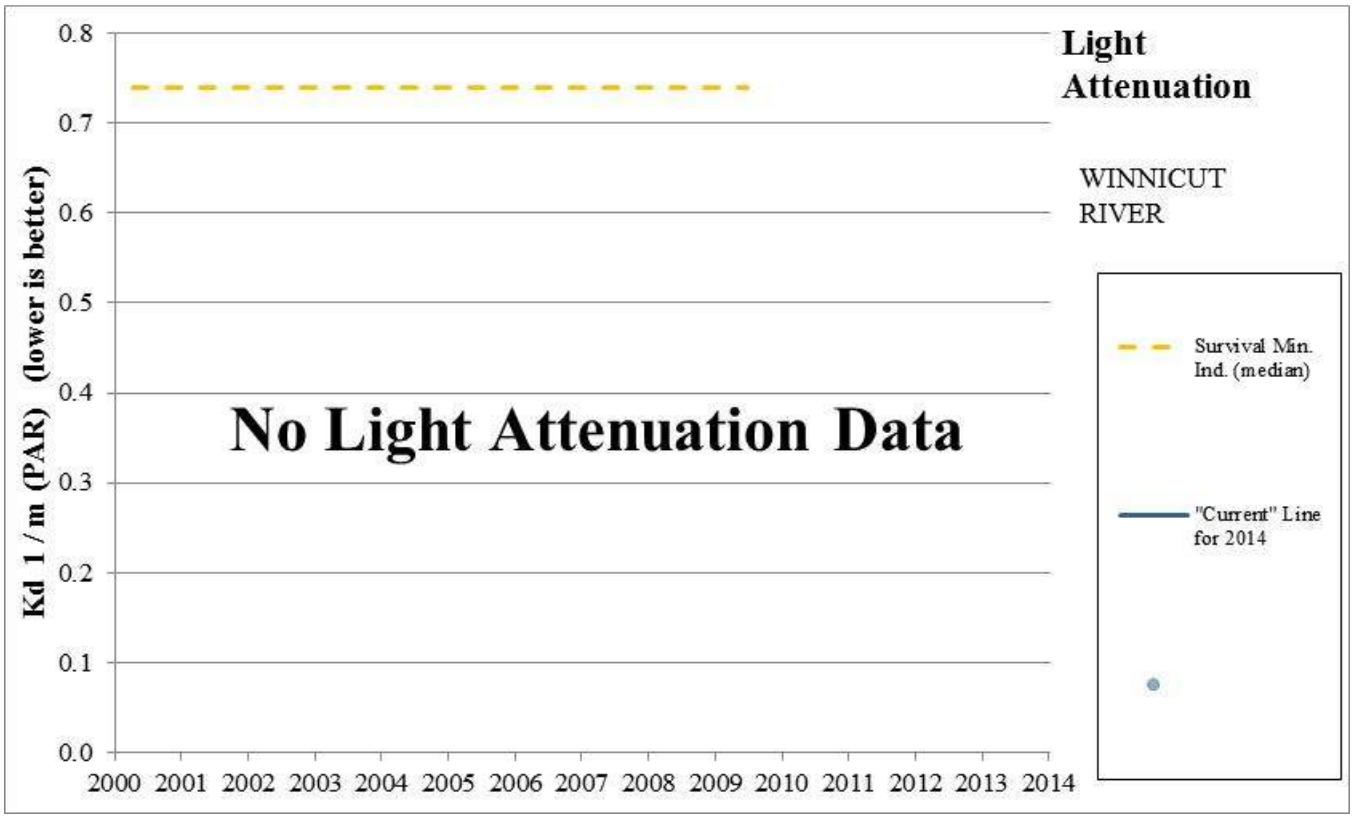
(NHEST600030904-01)

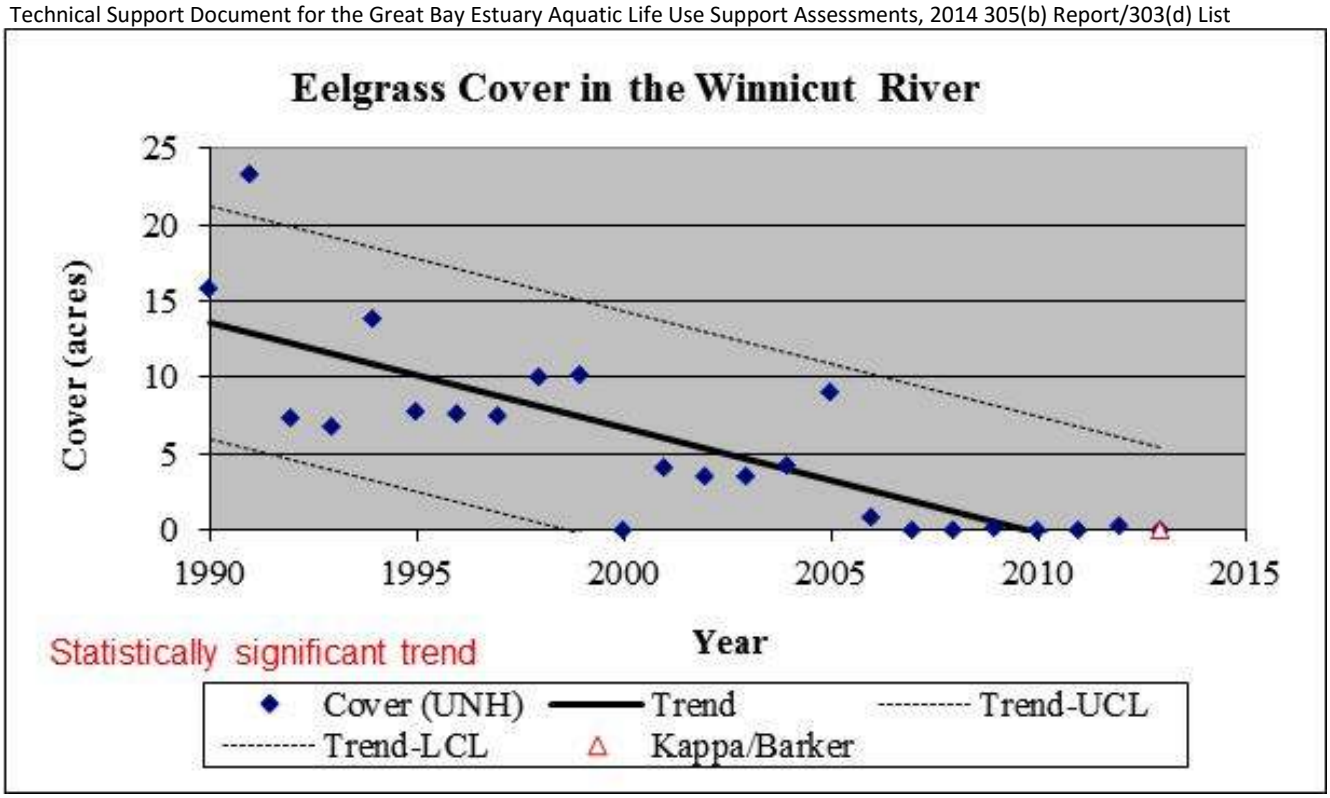
Indicator	Aquatic Life Use Category 2012 / 2014	2014
Chlorophyll-a	3-ND / 3-ND	The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L. However, there is no chlorophyll-a data for this assessment zone.
Dissolved Oxygen (mg/L)	2-M / 2-M	This assessment zone has only grab sample measurements for dissolved oxygen concentration and those measurements were only collected up through 2009 and one sample was measured below the criteria. The rest of the available data indicates that this assessment zone meets the dissolved oxygen criteria.
Dissolved Oxygen (% Saturation)	2-G / 2-M	This assessment zone has only grab sample measurements for dissolved oxygen 24 hour average percent saturation and those measurements were only collected up through 2008 and one sample was measured below the criteria. The rest of the available data indicates that this assessment zone meets the dissolved oxygen criteria.
Estuarine Bioassessments (eelgrass)	5-P / 5-P	The historical extent of eelgrass in this assessment zone was not available from the 1948, 1962, 1980, and 1981 datasets. Eelgrass was present from 1990 through 2006. The median current extent of eelgrass in 2011-2013 is 0 acres. Since 1990, the trend in eelgrass cover in this assessment zone is a loss of 77.0 %. The thresholds for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	3-ND / 3-ND	No data.
Total Nitrogen	3-ND / 3-ND	There are no 'current' total nitrogen data from which to calculate a median total nitrogen from 2008 through 2013. As such, this assessment zone has been assessed as 3-ND (No Data) for total nitrogen.

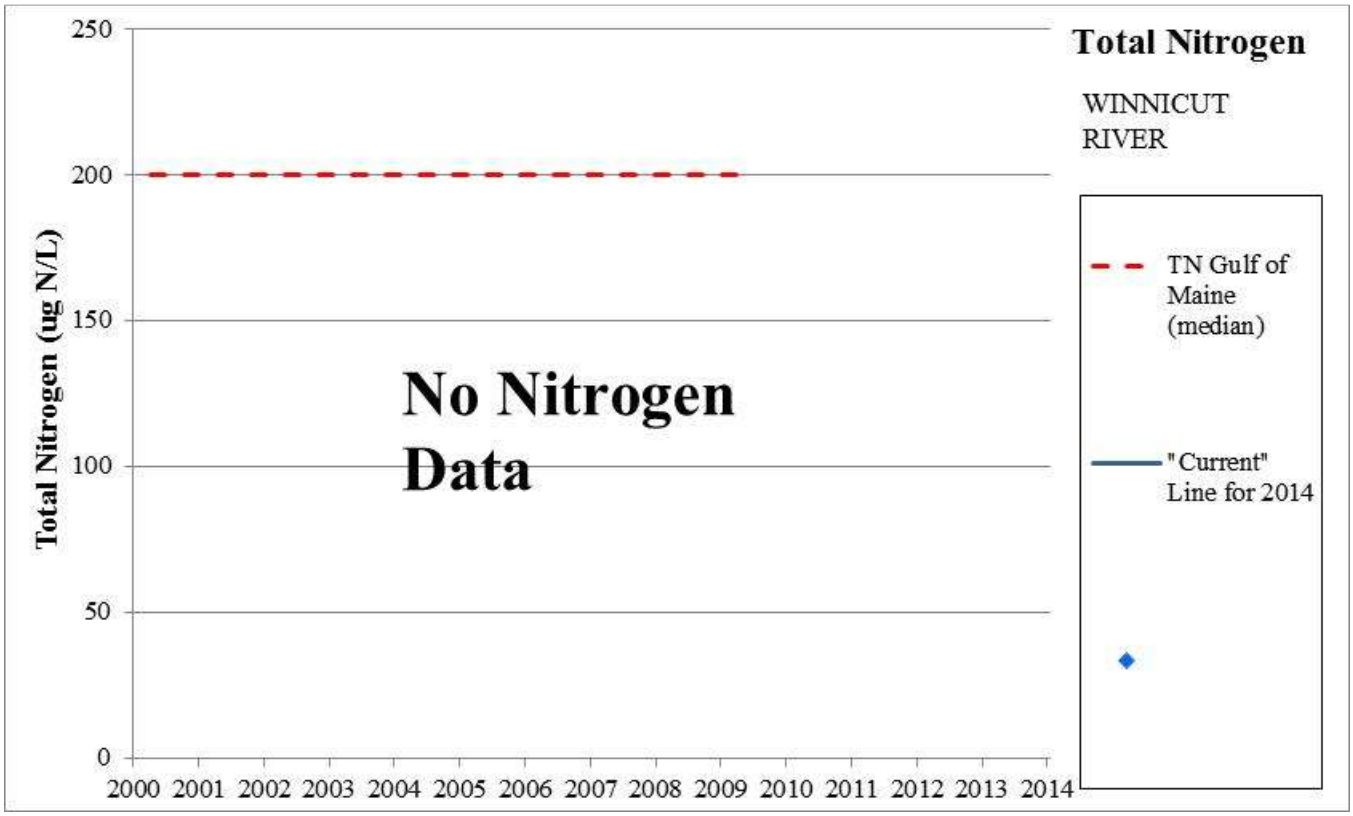

Chlorophyll-a
WINNICUT RIVER
ug Chl-a / L
No Chlorophyll-a Data
Chl-a Ind. (90th percentile)
"Current" Line for 2014
0
2
4
6
8
10
12
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014


Dissolved Oxygen Concentration
WINNICUT RIVER
Dissolved Oxygen, mg / L
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2014
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP
DO-PPM-GRAB-NCP
0
2
4
6
8
10
12
14
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014


Dissolved Oxygen Percent Saturation
WINNICUT RIVER
Dissolved Oxygen, Percent Saturation
140
120
100
80
60
40
20
0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2014
DO-PERC-24H-MEAN-NCP
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP


Light Attenuation
WINNICUT RIVER
Kd 1 / m (PAR) (lower is better)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
No Light Attenuation Data
Survival Min. Ind. (median)
"Current" Line for 2014


Eelgrass Cover in the Winnicut River
Cover (acres)
25
20
15
10
5
0
1990
1995
2000
2005
2010
2015
Year
Statistically significant trend
Cover (UNH)
Trend
Trend-UCL
Trend-LCL
Kappa/Barker


Total Nitrogen
WINNICUT RIVER
Total Nitrogen (ug N/L)
250
200
150
100
50
0
No Nitrogen Data
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
TN Gulf of Maine (median)
"Current" Line for 2014

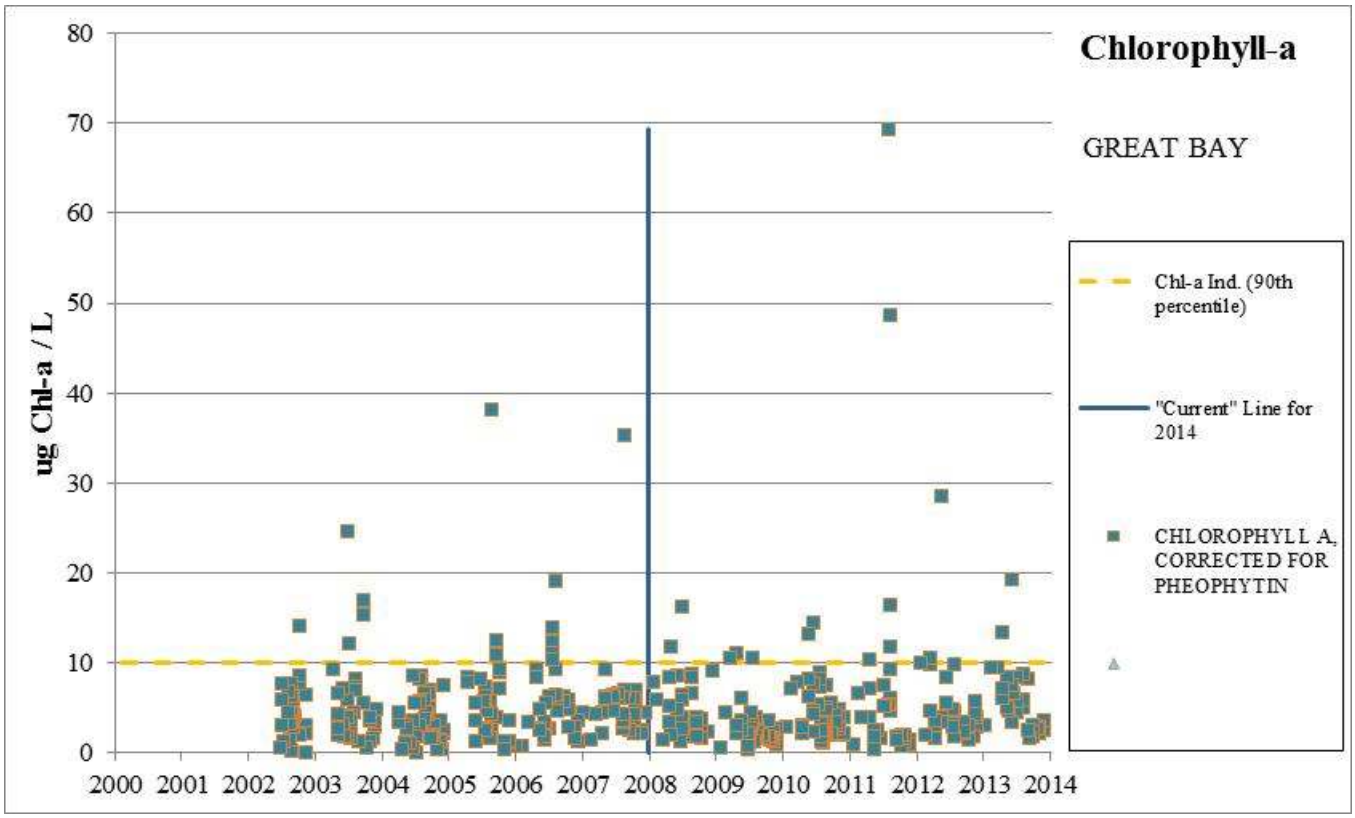
Winnicut River Assessment Zone (January 1, 2008 to November 7, 2014)	**Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	-	-	-	-	-
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	-	-	-	-	-
CHLOROPHYLL A, combined	-	-	-	-	-
DO-PERC-24H-MEAN-CP	-	-	-	-	-
DO-PERC-24H-MEAN-NCP	-	-	-	-	-
DO-PERC-2TIDE-GRAB-CP	4	72.4	84.3	-	98.8
DO-PERC-2TIDE-GRAB-NCP	4	80.9	89.6	-	97.3
DO-PPM-24HR-MIN-CP	-	-	-	-	-
DO-PPM-24HR-MIN-NCP	-	-	-	-	-
DO-PPM-GRAB-CP	5	6.6	7.0	-	7.4
DO-PPM-GRAB-NCP	6	4.2	8.3	-	10.5
LIGHT ATTENUATION COEFFICIENT	-	-	-	-	-
TURBIDITY	-	-	-	-	-
Day Ave of TN	-	-	-	-	-
Day Ave of TDN	-	-	-	-	-
Day Ave of DIN (NH3 + NO2/3)	-	-	-	-	-
Day Ave of NH3	-	-	-	-	-
Day Ave of PON	-	-	-	-	-
Day Ave of NO2/3	-	-	-	-	-

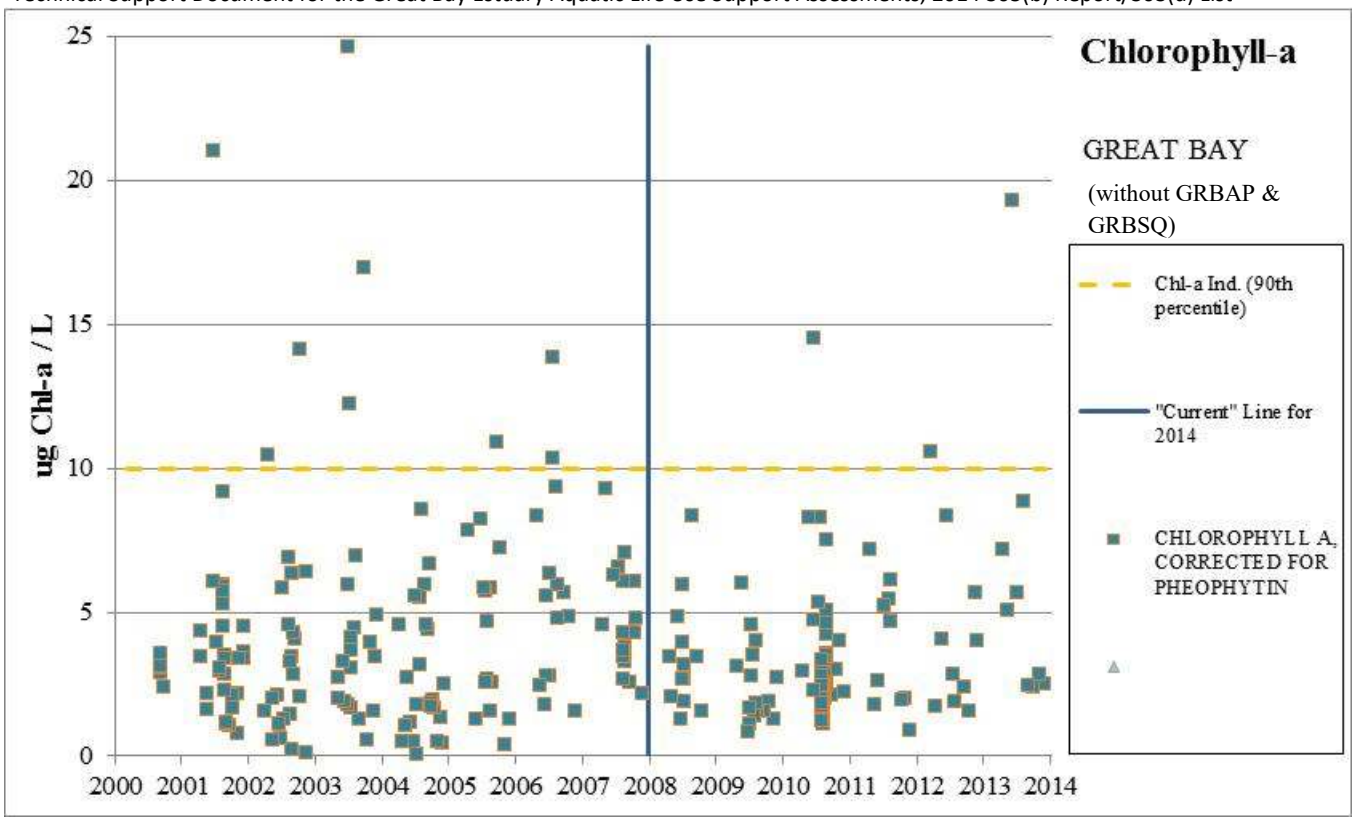
Assessment Zone = GREAT BAY

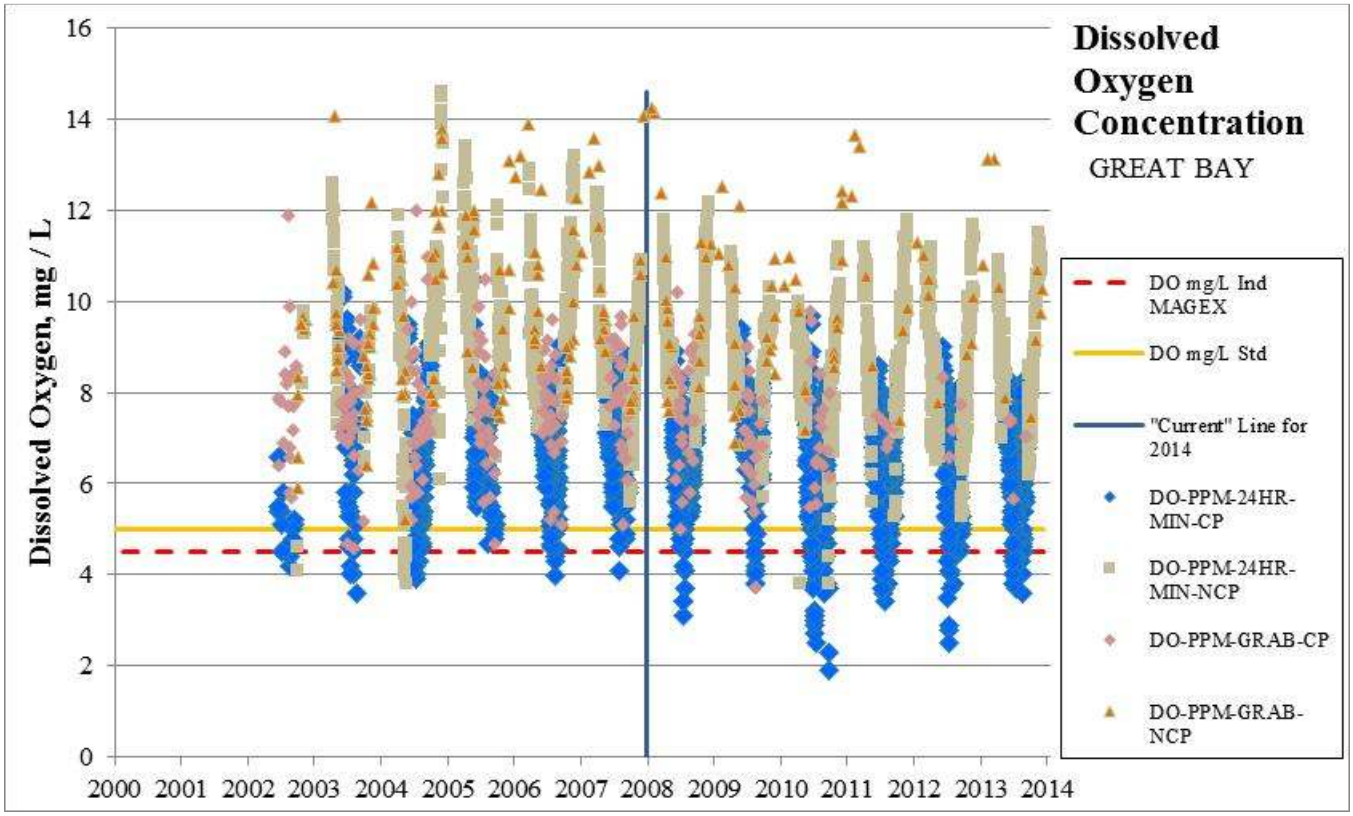
(NHEST600030904-02, NHEST600030904-03, NHEST600030904-04-02, NHEST600030904-04-03, NHEST600030904-04-04, NHEST600030904-04-05, NHEST600030904-04-06)

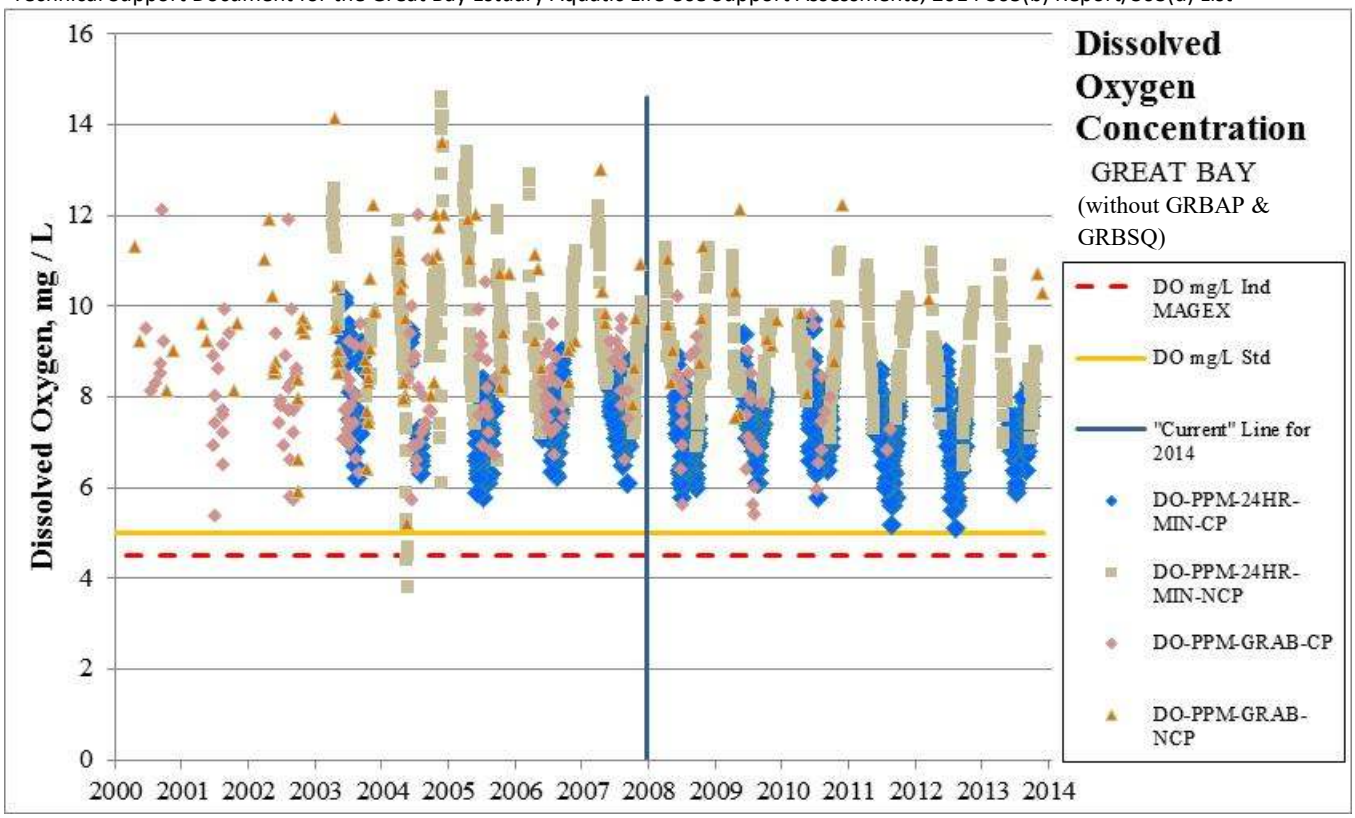
Indicator	Aquatic Life Use Category 2012 / 2014	2014
Chlorophyll-a	2-G / 2-M	The calculated 90th percentile for chlorophyll-a in this assessment zone is 8.9 ug/L (n = 249). The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L.
Dissolved Oxygen (mg/L)	2-G / 3-PNS	This assessment zone has 24 hour datalogger and grab measurements for dissolved oxygen concentration. One of the assigned stations (GRBSQ - Squamscott River datasonde at RR bridge) is at the mouth of the Squamscott River, precisely at the divide between the Squamscott River and Great Bay assessment zones. The very low readings from GRBSQ are a cause for concern. While GRBSQ more accurately represents the conditions in the Squamscott River than the entirety of Great Bay proper, it does indicate low DO issues are likely to extend into portions of Great Bay. The primary sampled station (GRBGB) inside of the Great Bay assessment zone also shows marginal dissolved oxygen samples including concentrations in 2011 and 2012 dipping below 5.5 mg/L. Considering the GRBGB data and the very low readings from GRBSQ, conditions are severe enough at this time to warrant removal of the full support assessment for dissolved oxygen concentration and downgrade to Insufficient Information – Potentially Not Supporting.
Dissolved Oxygen (% Saturation)	2-G / 2-M	This assessment zone has 24 hour datalogger and grab measurements for dissolved oxygen percent saturation. One of the assigned stations (GRBSQ - Squamscott River datasonde at RR bridge) is at the mouth of the Squamscott River, precisely at the divide between the Squamscott River and Great Bay assessment zones. While GRBSQ more accurately represents the conditions in the Squamscott River than the entirety of Great Bay proper, it does indicate low DO issues are likely to extend into portions of Great Bay. The low readings from GRBSQ are not severe enough at this time to warrant removal of the full support assessment for dissolved oxygen percent saturation.
Estuarine Bioassessments (eelgrass)	5-P / 5-P	The historical extent of eelgrass in this assessment zone was 2,130.7 acres from the 1948, 1962, 1980, and 1981 datasets. The median current extent of eelgrass in 2011-2013 is 1,598.4 acres, which is a 25.0% decrease. Since 1990, the trend in eelgrass cover in this assessment zone is a loss of 21.5%. The thresholds for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	5-M / 5-M	Median=1.180 m^-1 (n=173). For an eelgrass restoration depth of 2 m, the light attenuation coefficient threshold is 0.75 m^-1. This assessment zone historically had eelgrass growing in both the shallows and deeper habitat making the 2m restoration depth a valid target. Therefore, the impaired (5-M) listing from the 2012 303d list has been retained.
Total Nitrogen	5-M / 3-PNS	The median total nitrogen from 2008 through 2013 was 391 ug/L (n=62) when considering just the stations in the middle of Great Bay; and 410 ug/L (n=176) when including the boundary stations GRBSQ and GRBAP. New Hampshire is no longer comparing ambient total nitrogen data to the total nitrogen numeric indicators used in the 2012 assessment. Per the court settlement (Docket No. 2013-0119), NHDES has agreed to revert to using the narrative water quality criteria, which requires the use of an integrated evaluation. This assessment zone has not demonstrated dissolved oxygen exceedences at station GRBGB in the middle of Great Bay. However, when considering all sampling stations of Great Bay there are areas in the southwest that likely exhibit poor dissolved oxygen. Likewise, the calculated 90th percentile chlorophyll-a in this assessment zone is 8.9 ug/L (n = 249) which is just below the threshold described in the CALM. Chlorophyll-a experiences peak concentrations annually from 10-69 ug/L in the south western area. The eelgrass beds are degraded and the available light attenuation (median=1.180 m^-1 (n=173)) is poor. For shallow systems, it is expected that changes in macroalgae will precede changes in phytoplankton (McGlathery, Sundbäck, & Anderson, 2007) (Valiela, et al., 1997), as appears to be occurring in the Great Bay assessment zone. There is evidence that macroalgae is impacting eelgrass and changing the species composition and diversity in Great

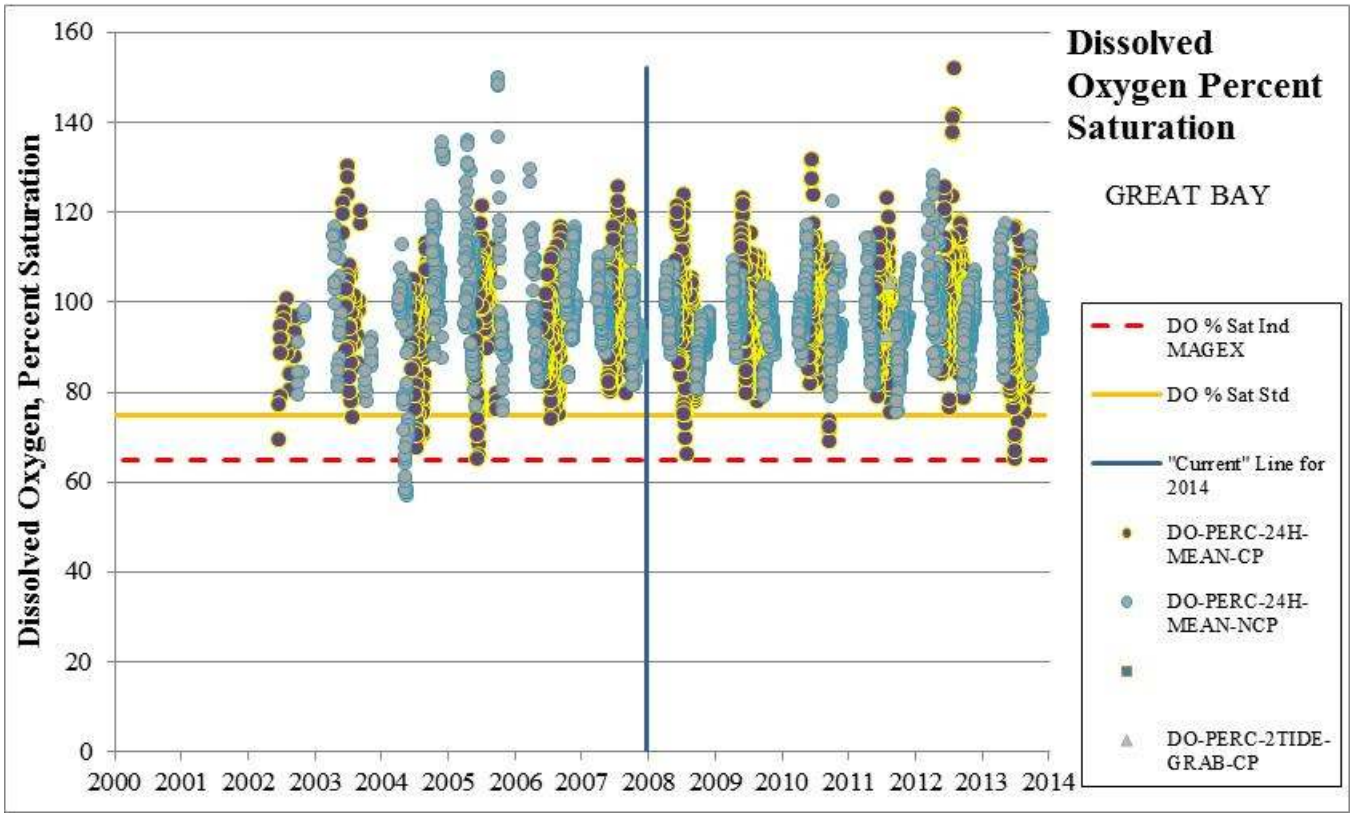
		Bay. Using data from Great Bay (Pe'eri, Morrison, Short, Mathieson, Brook, & Trowbridge, 2008), NHDES determined that macroalgae mats had replaced nearly 5.7% of the area formerly occupied by eelgrass in Great Bay in 2007 (NHDES, 2009) and that replaced area has not been recolonized by eelgrass. Some of the loss of eelgrass in the intertidal zone is consistent with smothering by macroalgae. The foremost authority on macroalgae for this estuary, Dr. Arthur C. Mathieson, commented on the draft 2012 303(d) that he remains concerned about the macroalgae and epiphyte conditions in Great Bay (NHDES, 2013). Some of the classic indicators of nutrient eutrophication are present in this assessment zone and total nitrogen remains elevated in portions of the assessment zone. As the discussion above illustrates, there is a clear nutrient "signature" in the data. It is less clear, at this time, whether the response datasets demonstrate sufficient power to determine that the eutrophication effects on designated uses can be attributed to total nitrogen alone. Given that uncertainty, impairment is not warranted under New Hampshire's narrative standard. As such, this assessment zone has been assessed as Insufficient Information – Potentially Not Supporting (3-PNS) for total nitrogen.

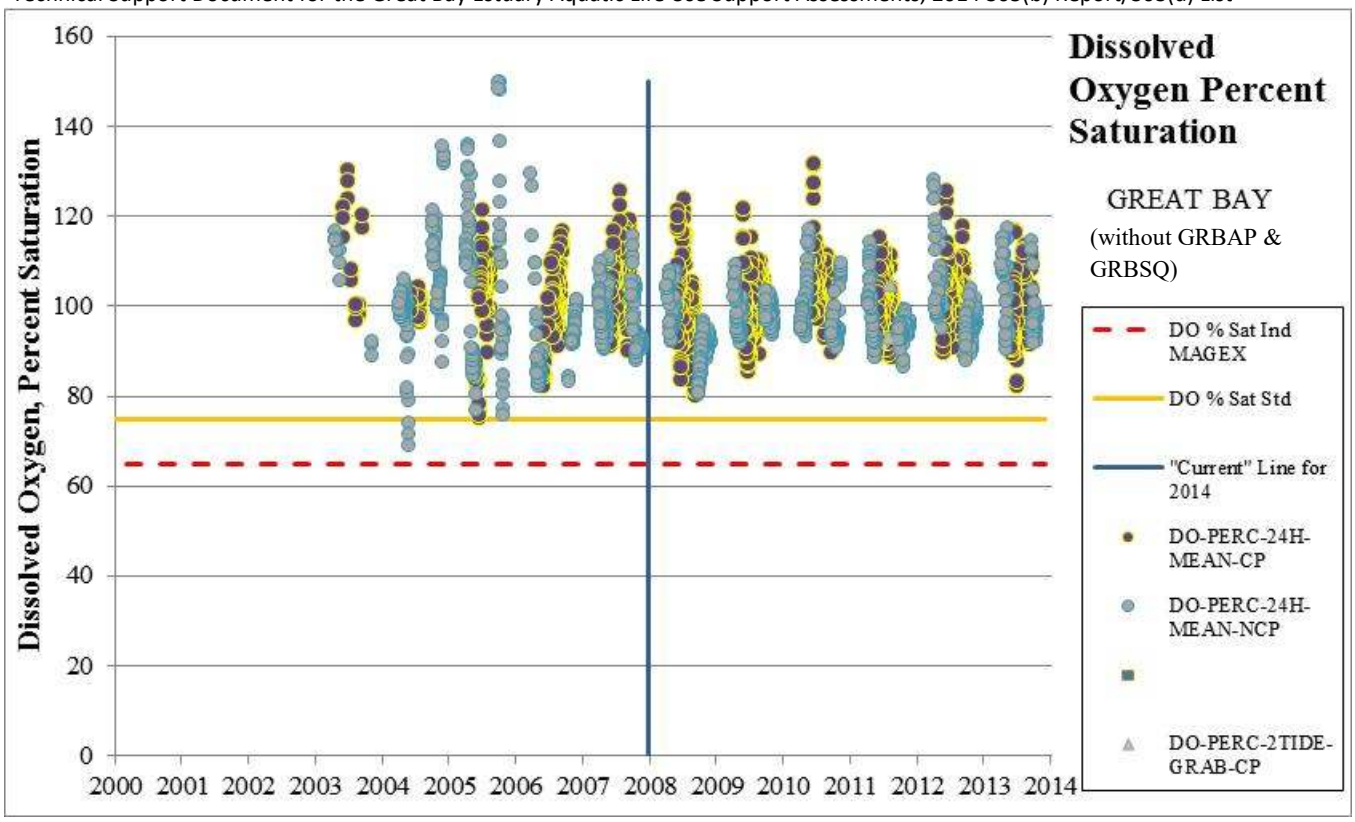


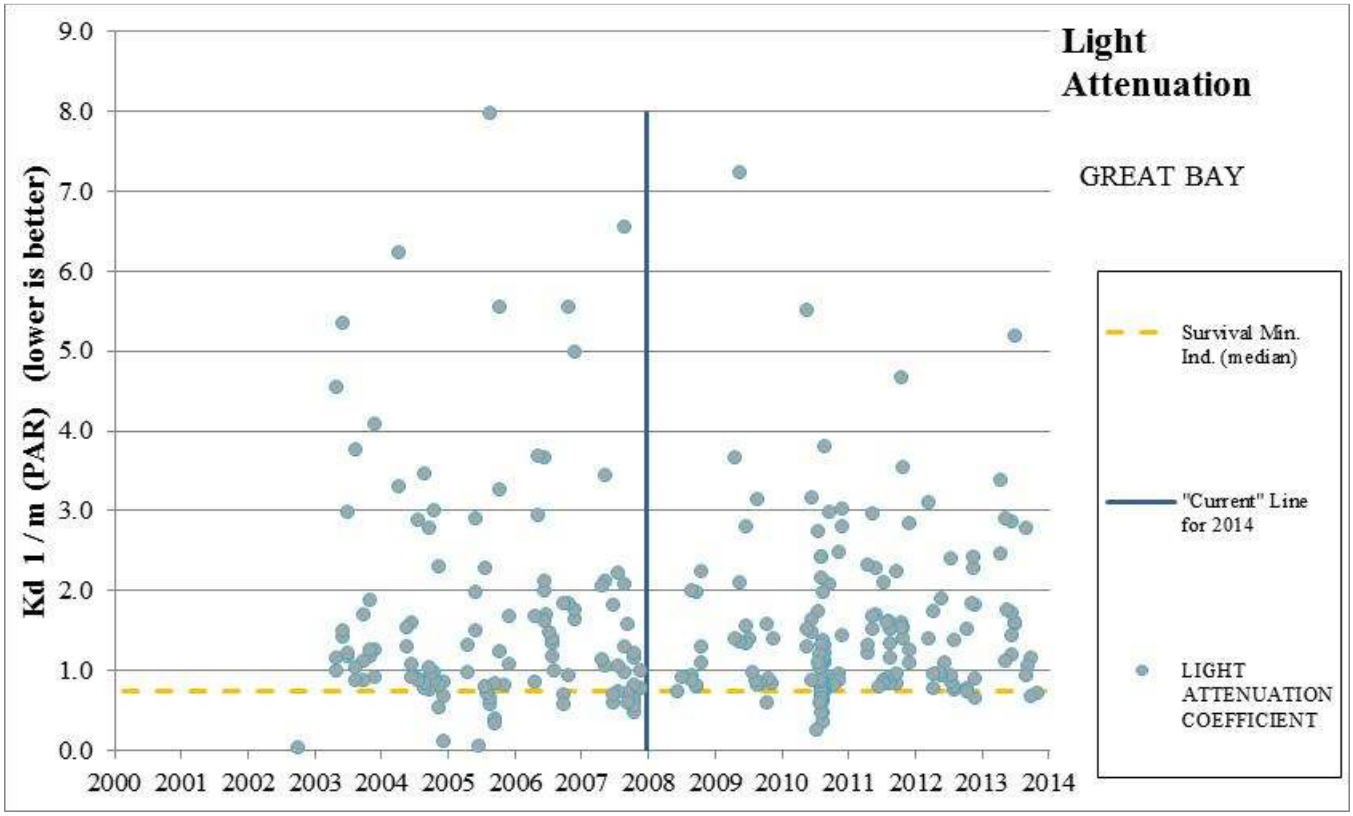

Chlorophyll-a
GREAT BAY
(without GRBAP & GRBSQ)
ug Chl-a / L
Chl-a Ind. (90th percentile)
"Current" Line for 2014
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN
0
5
10
15
20
25
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014

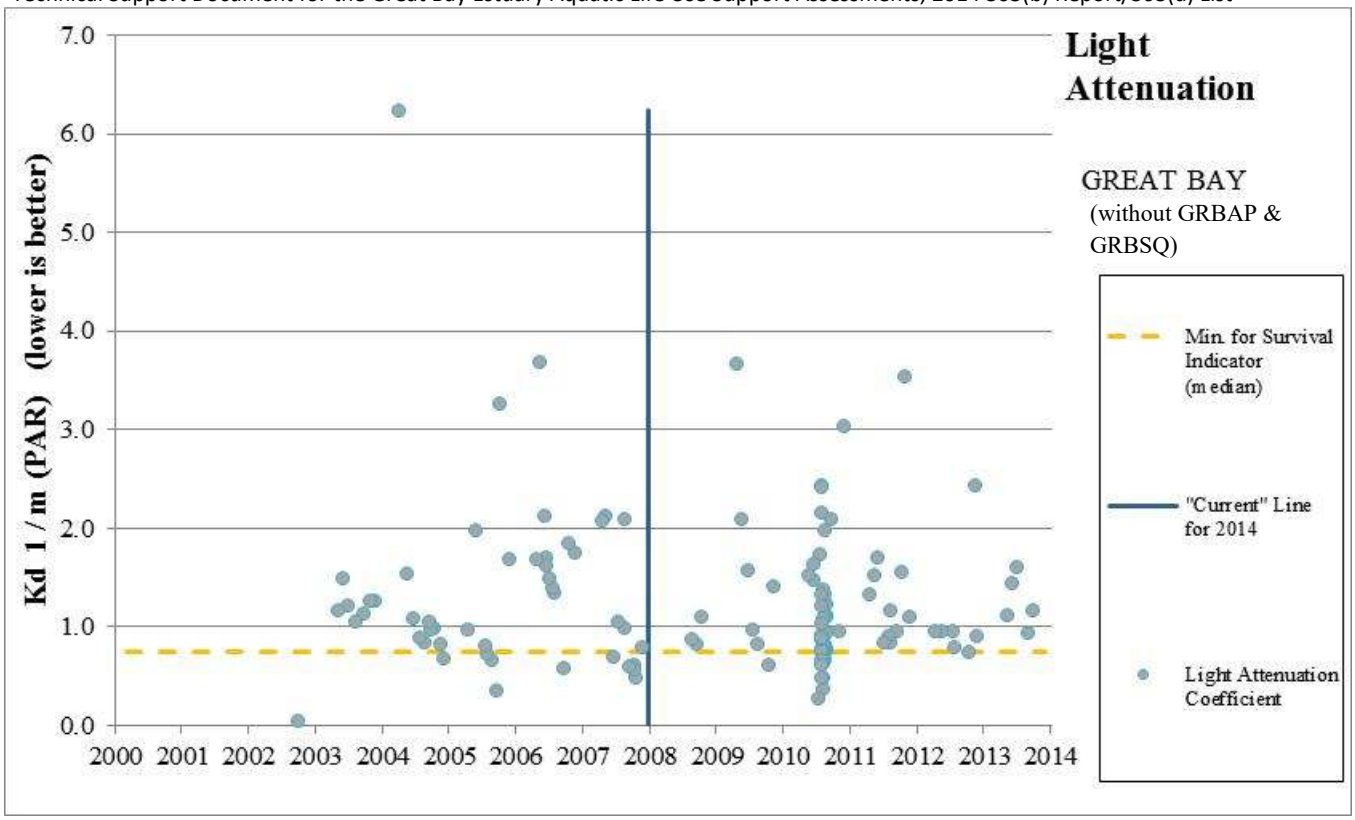

Dissolved Oxygen Concentration
GREAT BAY
Dissolved Oxygen, mg / L
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2014
DO-PPM-24HR-MIN-CP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP
DO-PPM-GRAB-NCP
0
2
4
6
8
10
12
14
16
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014

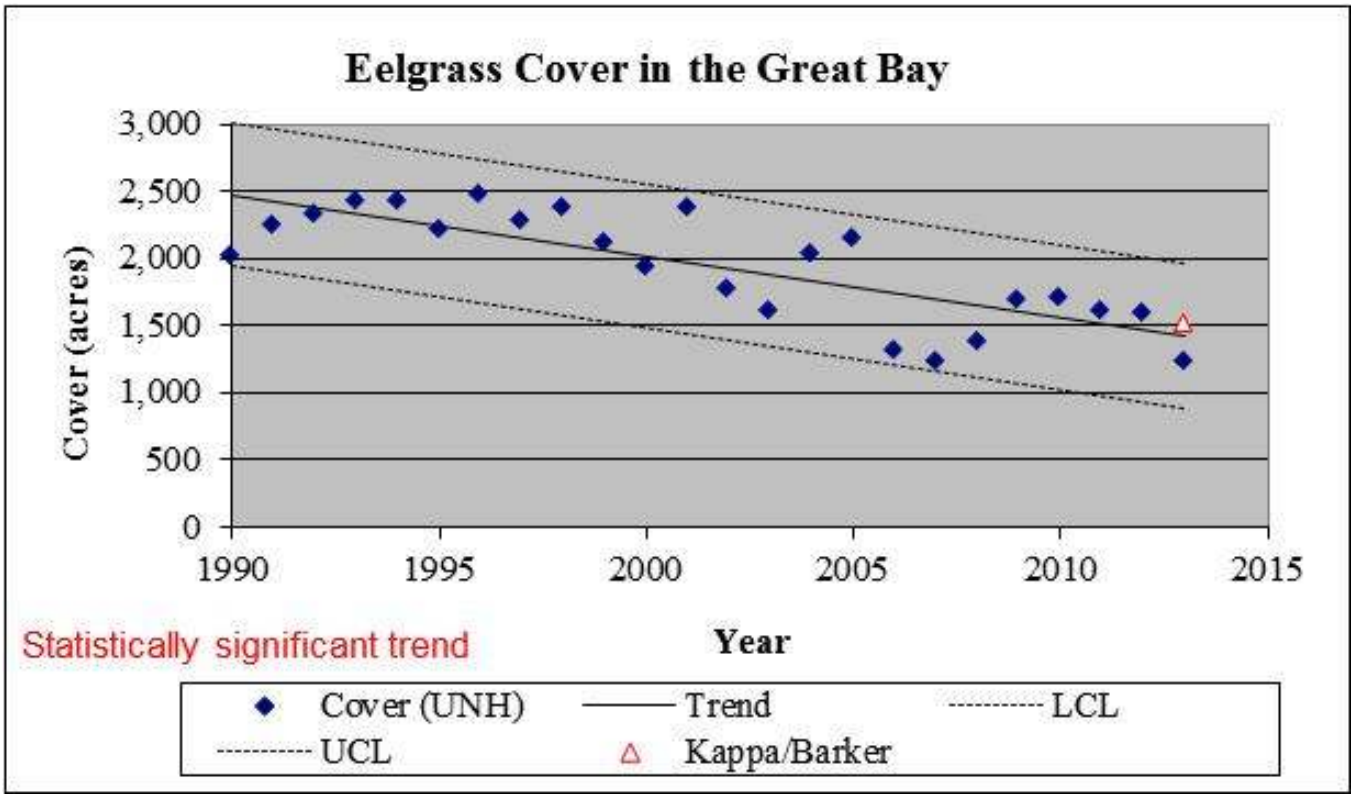

Dissolved Oxygen Concentration
GREAT BAY
(without GRBAP & GRBSQ)
Dissolved Oxygen, mg / L
0
2
4
6
8
10
12
14
16
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2014
DO-PPM-24HR-MIN-CP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP
DO-PPM-GRAB-NCP

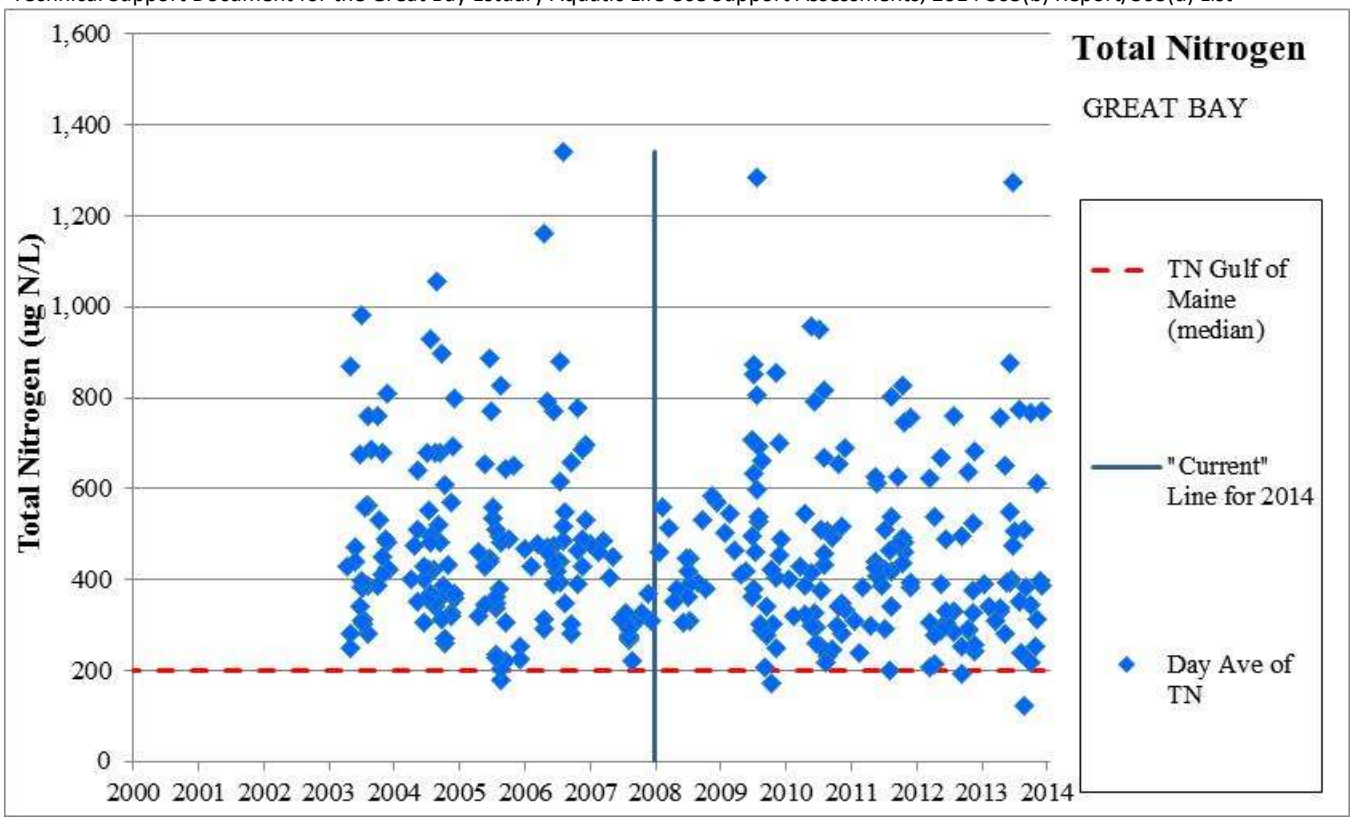

Dissolved Oxygen Percent Saturation
GREAT BAY
Dissolved Oxygen, Percent Saturation
0
20
40
60
80
100
120
140
160
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2014
DO-PERC-24H-MEAN-CP
DO-PERC-24H-MEAN-NCP
DO-PERC-2TIDE-GRAB-CP

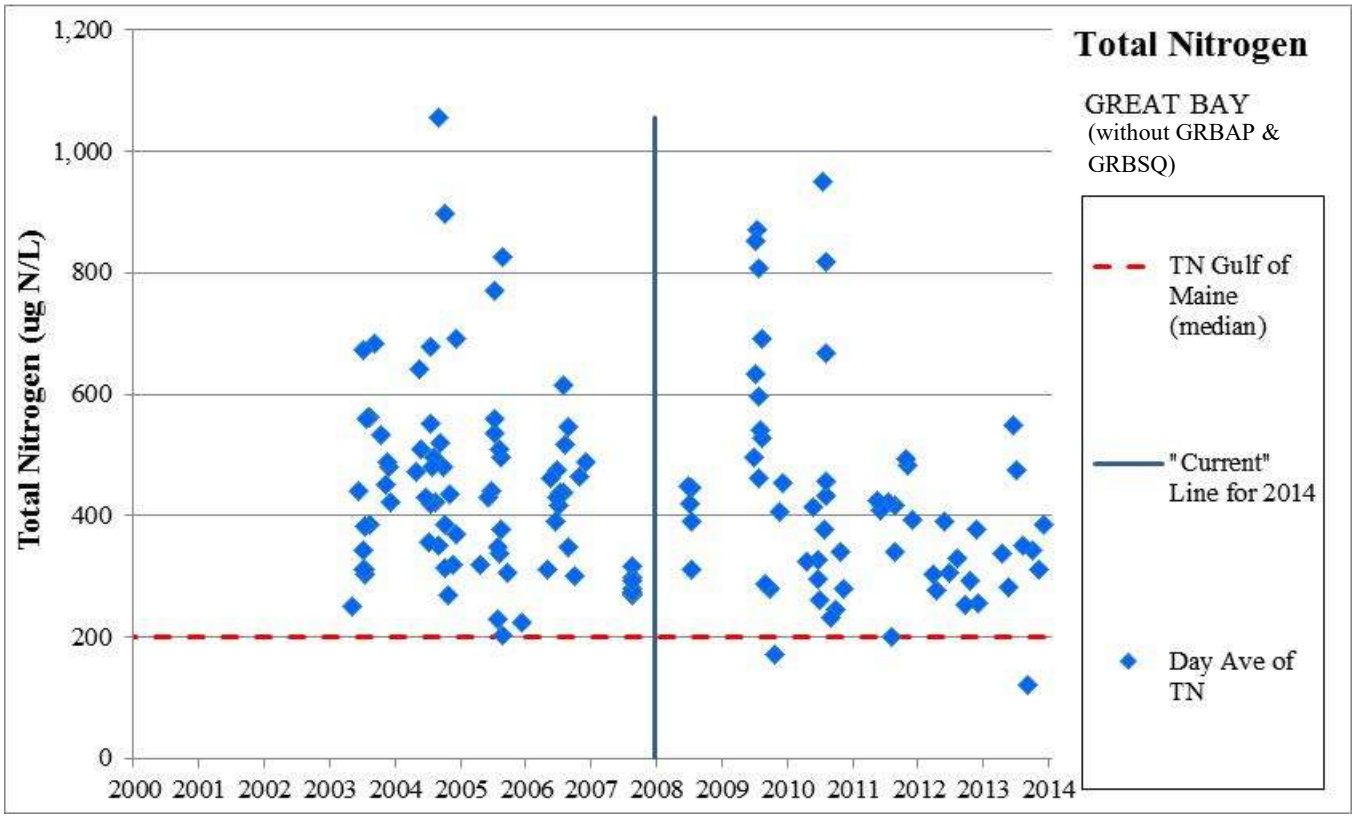

Dissolved Oxygen Percent Saturation
GREAT BAY
(without GRBAP & GRBSQ)
Dissolved Oxygen, Percent Saturation
160
140
120
100
80
60
40
20
0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2014
DO-PERC-24H-MEAN-CP
DO-PERC-24H-MEAN-NCP
DO-PERC-2TIDE-GRAB-CP


Light Attenuation
GREAT BAY
Kd 1 / m (PAR) (lower is better)
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Survival Min. Ind. (median)
"Current" Line for 2014
LIGHT ATTENUATION COEFFICIENT


Light Attenuation
GREAT BAY
(without GRBAP & GRBSQ)
Kd 1 / m (PAR) (lower is better)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Min. for Survival Indicator (median)
"Current" Line for 2014
Light Attenuation Coefficient


Eelgrass Cover in the Great Bay
Cover (acres)
3,000
2,500
2,000
1,500
1,000
500
0
1990
1995
2000
2005
2010
2015
Year
Statistically significant trend
Cover (UNH)
Trend
LCL
UCL
Kappa/Barker


Total Nitrogen
GREAT BAY
Total Nitrogen (ug N/L)
1,600
1,400
1,200
1,000
800
600
400
200
0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
TN Gulf of Maine (median)
"Current" Line for 2014
Day Ave of TN

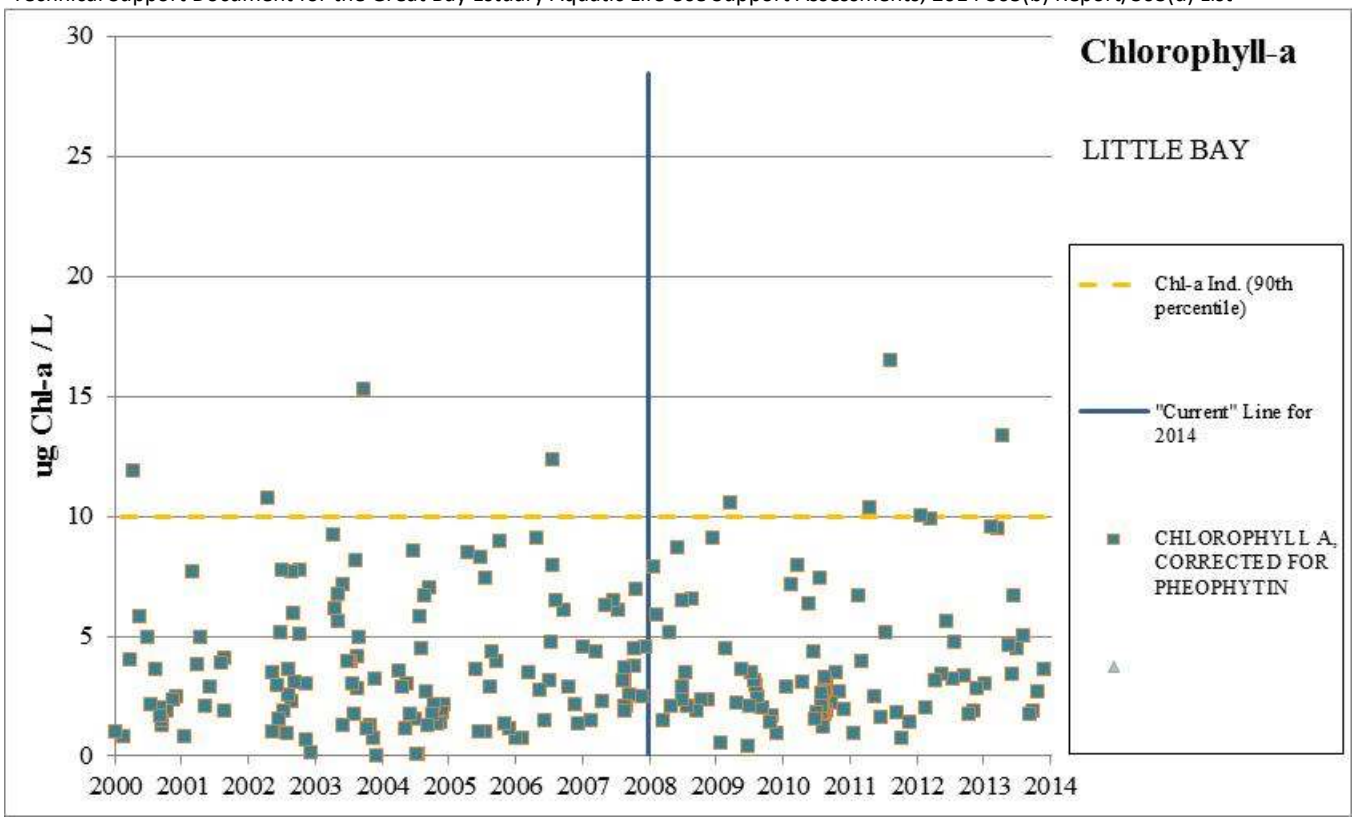

Total Nitrogen
GREAT BAY
(without GRBAP & GRBSQ)
Total Nitrogen (ug N/L)
1,200
1,000
800
600
400
200
0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
TN Gulf of Maine (median)
"Current" Line for 2014
Day Ave of TN

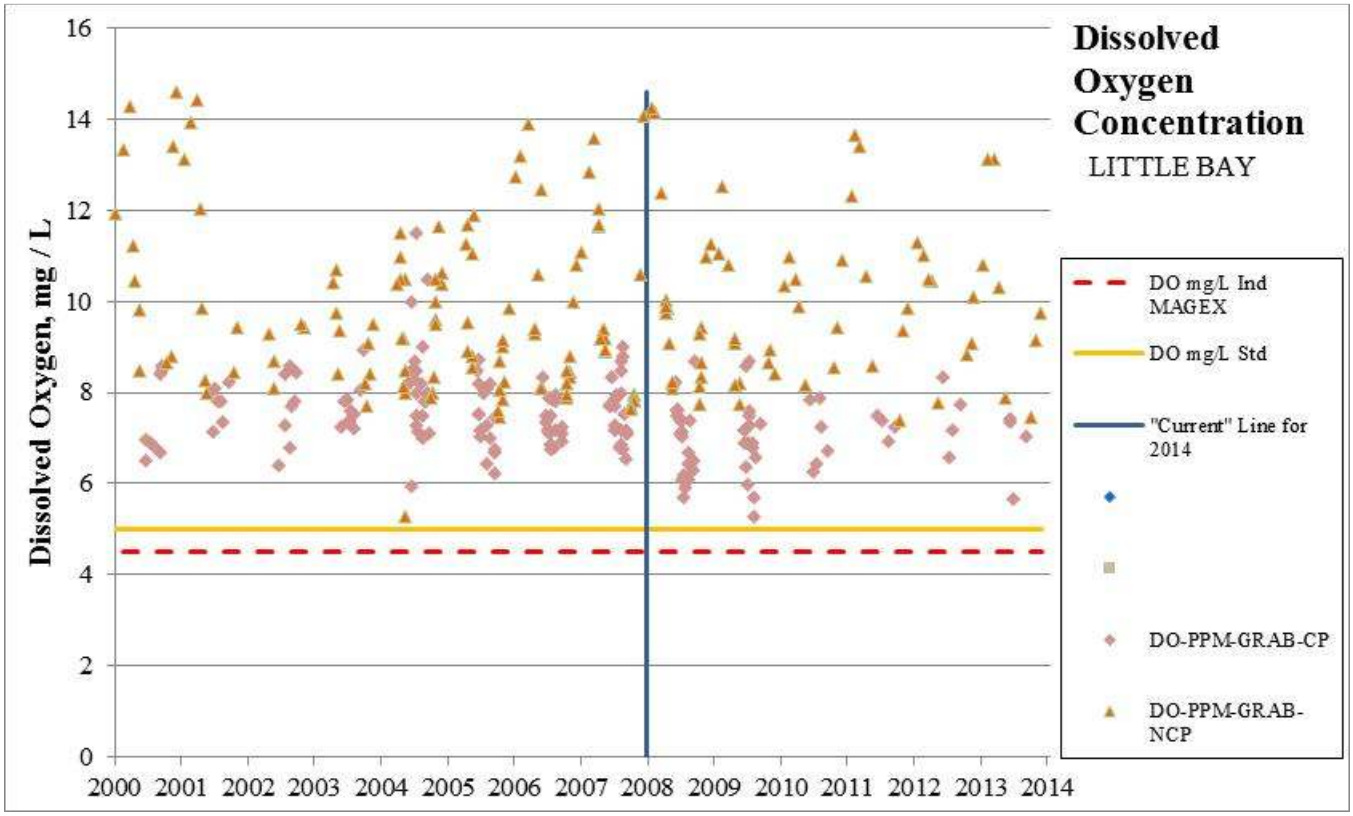
Great Bay Assessment Zone (January 1, 2008 to November 7, 2014)	**Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	249	0.4	3.1	**8.9**	69.4
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	-	-	-	-	-
CHLOROPHYLL A, combined	249	0.4	3.1	8.9	69.4
DO-PERC-24H-MEAN-CP	1,267	65.4	95.9	109.5	152.0
DO-PERC-24H-MEAN-NCP	1,289	75.7	95.5	105.1	128.4
DO-PERC-2TIDE-GRAB-CP	2	92.6	98.6	-	104.5
DO-PERC-2TIDE-GRAB-NCP	-	-	-	-	-
DO-PPM-24HR-MIN-CP	1,376	1.9	6.8	7.9	9.7
DO-PPM-24HR-MIN-NCP	1,332	3.8	8.9	10.7	12.2
DO-PPM-GRAB-CP	83	3.7	7.3	8.7	10.2
DO-PPM-GRAB-NCP	88	6.9	9.7	12.4	14.3
LIGHT ATTENUATION COEFFICIENT	173	0.281	**1.180**	2.838	7.250
TURBIDITY	2,641	1.0	56.0	551.4	2,630.0
Day Ave of TN	176	122	**410**	758	1,285
Day Ave of TDN	201	50	324	593	897
Day Ave of DIN (NH3 + NO2/3)	199	5	146	290	556
Day Ave of NH3	199	3	48	166	333
Day Ave of PON	52	10	60	174	526
Day Ave of NO2/3	204	3	81	180	299

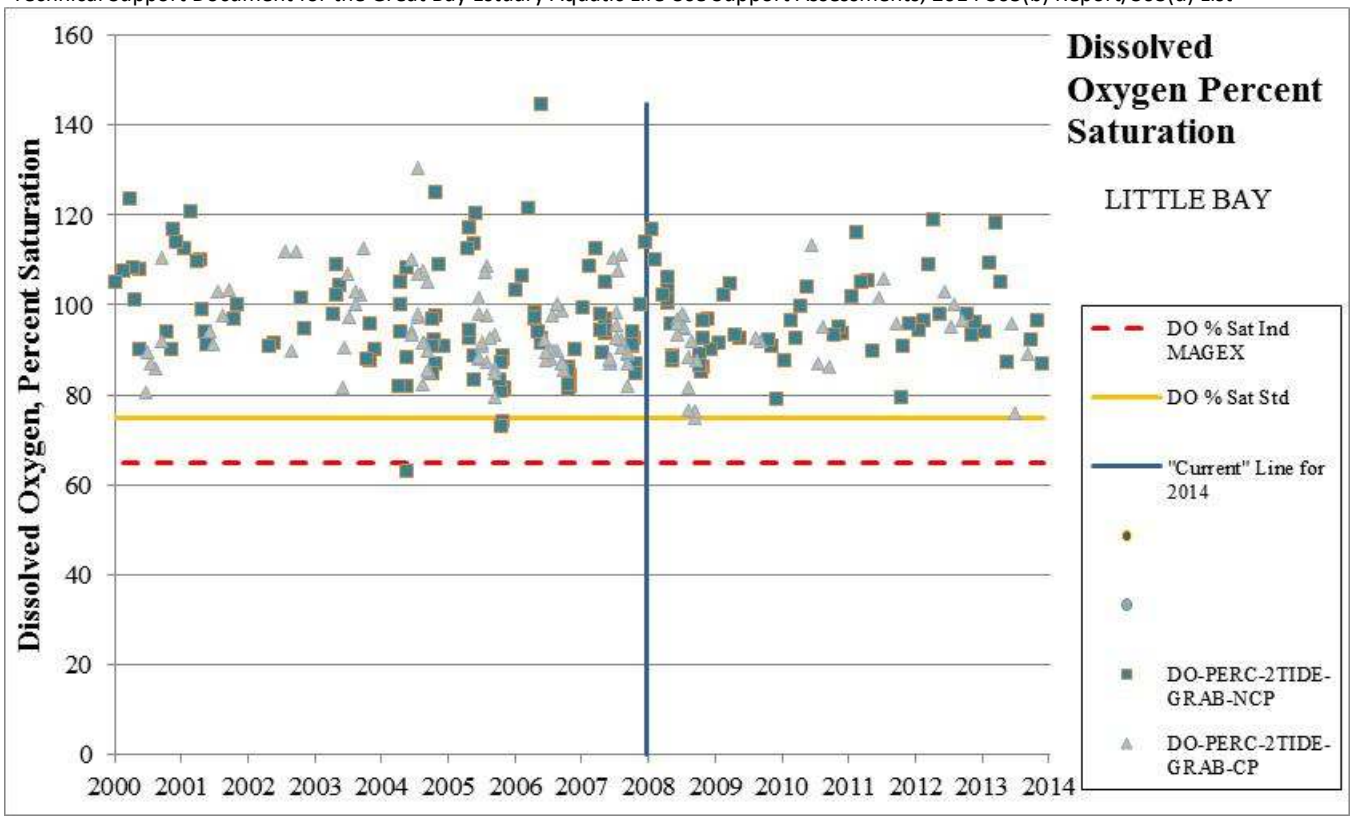
Assessment Zone = LITTLE BAY

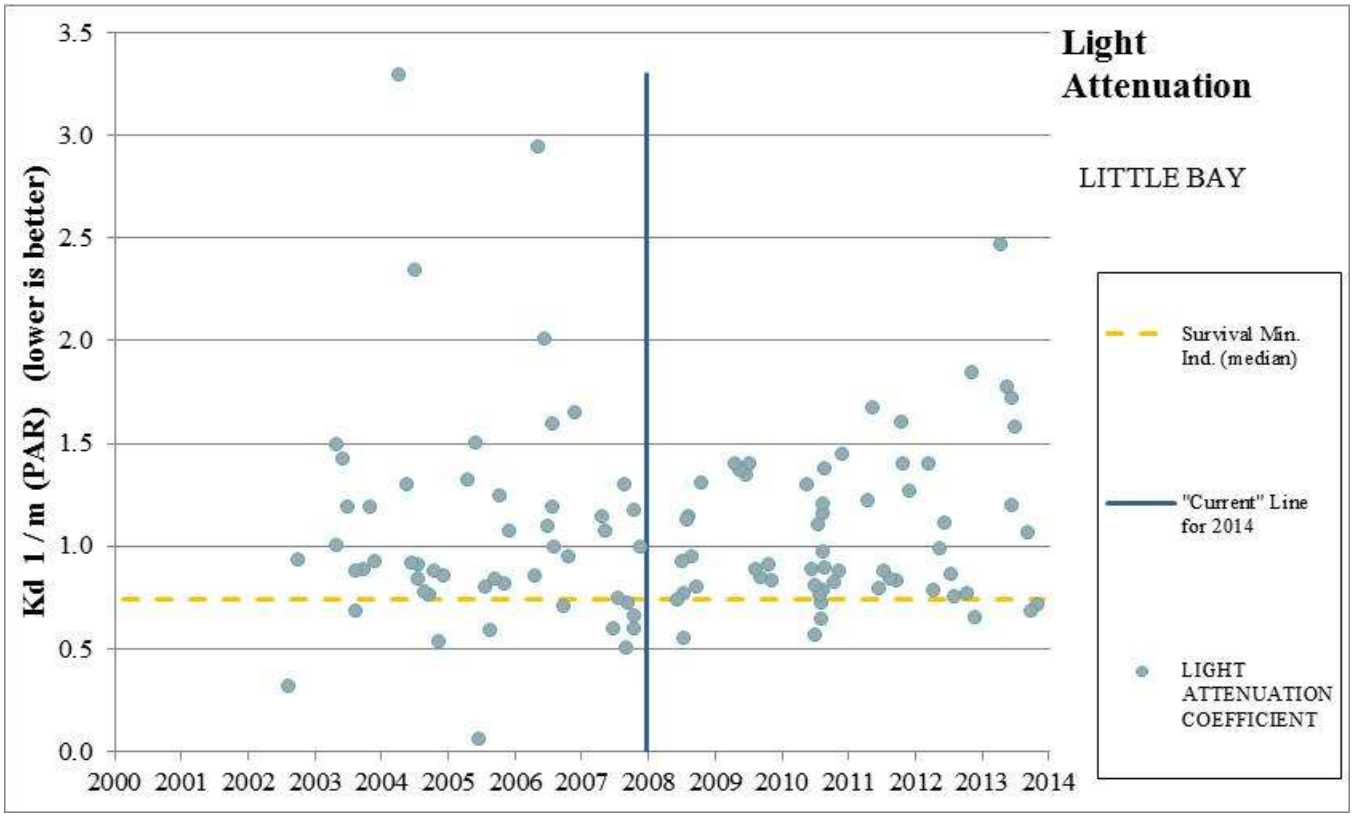
(NHEST600030904-06-10, NHEST600030904-06-11, NHEST600030904-06-12, NHEST600030904-06-14, NHEST600030904-06-15, NHEST600030904-06-18, NHEST600030904-06-19)

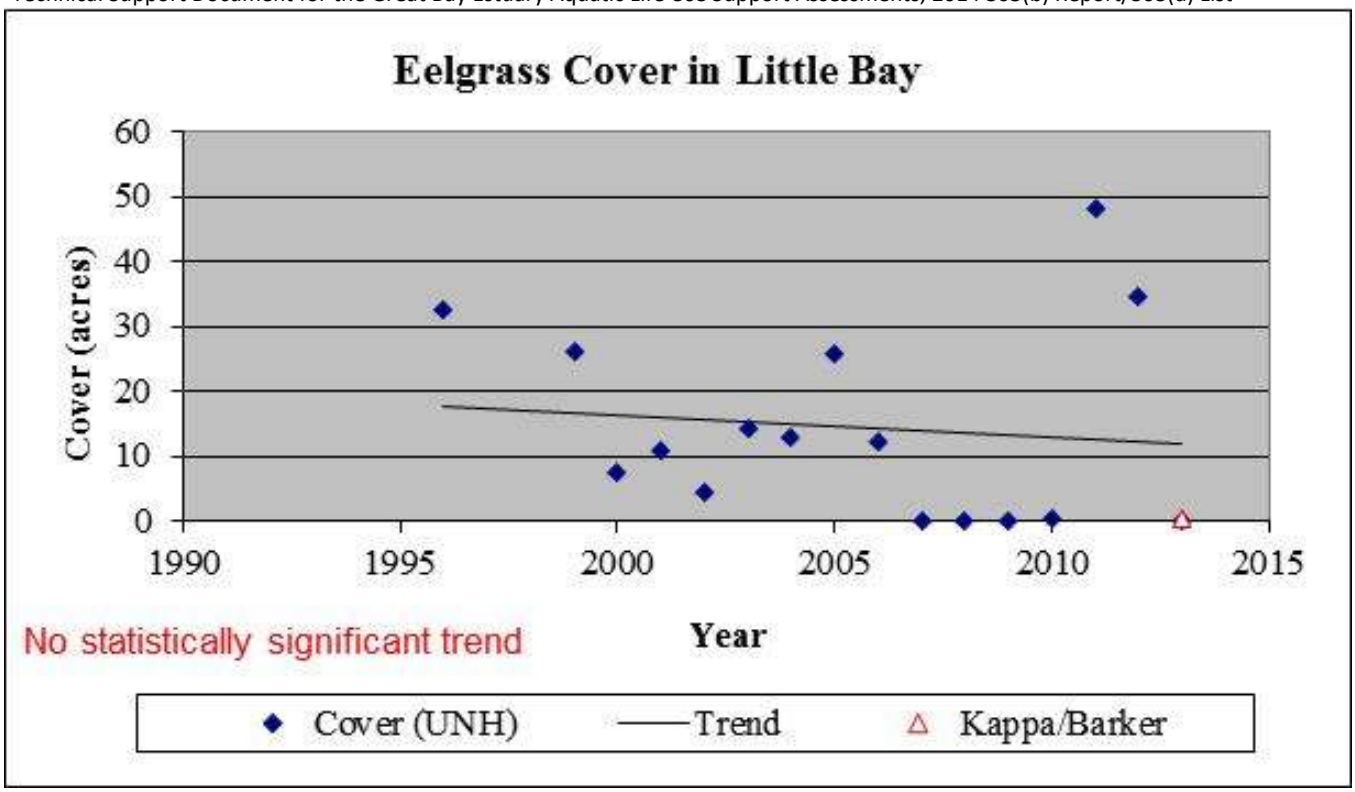
Indicator	Aquatic Life Use Category 2012 / 2014	2014
Chlorophyll-a	2-G / 2-M	The calculated 90th percentile chlorophyll-a in this assessment zone is 8.9 ug/L (n = 95) and a maximum reading of 16.5 ug/L. The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L.
Dissolved Oxygen (mg/L)	2-M /2-G	This assessment zone has only grab sample measurements for dissolved oxygen concentration and those measurements have been collected up through 2013. That available data indicates that this assessment zone meets the dissolved oxygen concentration criteria.
Dissolved Oxygen (% Saturation)	2-G /2-M	This assessment zone has only grab sample measurements which can be used to evaluate against the dissolved oxygen 24 hour average percent saturation criteria and those measurements have been collected up through 2013 and there were occasional grab samples at or below 75 percent. The weight of the available data indicates that this assessment zone meets the dissolved oxygen percent saturation criteria.
Estuarine Bioassessments (eelgrass)	5-P /5-P	The historical extent of eelgrass in this assessment zone was 252 acres from the 1948, 1962, 1980, and 1981 datasets. The median current extent of eelgrass in 2011-2013 is 34.6 acres, which is a decrease of 86.3%. There is no significant trend in eelgrass cover in this assessment zone since 1990. The thresholds for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	5-M /5-M	Median=0.948 m^-1 (n=60). For an eelgrass restoration depth of 2 m, the light attenuation coefficient threshold is 0.75 m^-1. This assessment zone historically had eelgrass growing in both the shallows and deeper habitat making the 2m restoration depth a valid target. Therefore, the impaired (5-M) listing from the 2012 303d list has been retained.
Total Nitrogen	5-M /3-PNS	The median total nitrogen from 2008 through 2013 was 390 ug/L (n=78). New Hampshire is no longer comparing ambient total nitrogen data to the total nitrogen numeric indicators used in the 2012 assessment as translators for the narrative water quality criteria. Although based on only grab samples, the measurements in this assessment zone do not demonstrate dissolved oxygen concentration exceedences and there were occasional grab samples at or below 75 percent saturation. The calculated 90th percentile chlorophyll-a in this assessment zone is 8.9 ug/L (n = 95) and a maximum reading of 16.5 ug/L. Like dissolved oxygen, chlorophyll-a is marginally better than the indicator. The eelgrass beds are severely degraded (86.3% reduction from historic) and the available light attenuation (median=0.948 m^-1 (n=60)) is poor. For shallow systems, it is expected that changes in macroalgae will precede changes in phytoplankton (McGlathery, Sundbäck, & Anderson, 2007) (Valiela, et al., 1997), as appears to be occurring in the Great Bay Estuary. At this time there are some of the classic indicators of nutrient eutrophication present in this assessment zone and Total Nitrogen remains elevated. However, there are insufficient response datasets leading to the determine that eutrophication by total nitrogen is alone is not known to be strong enough to warrant impairment under New Hampshire's narrative standard. As such, this assessment zone has been assessed as Insufficient Information – Potentially Not Supporting (3-PNS) for total nitrogen.

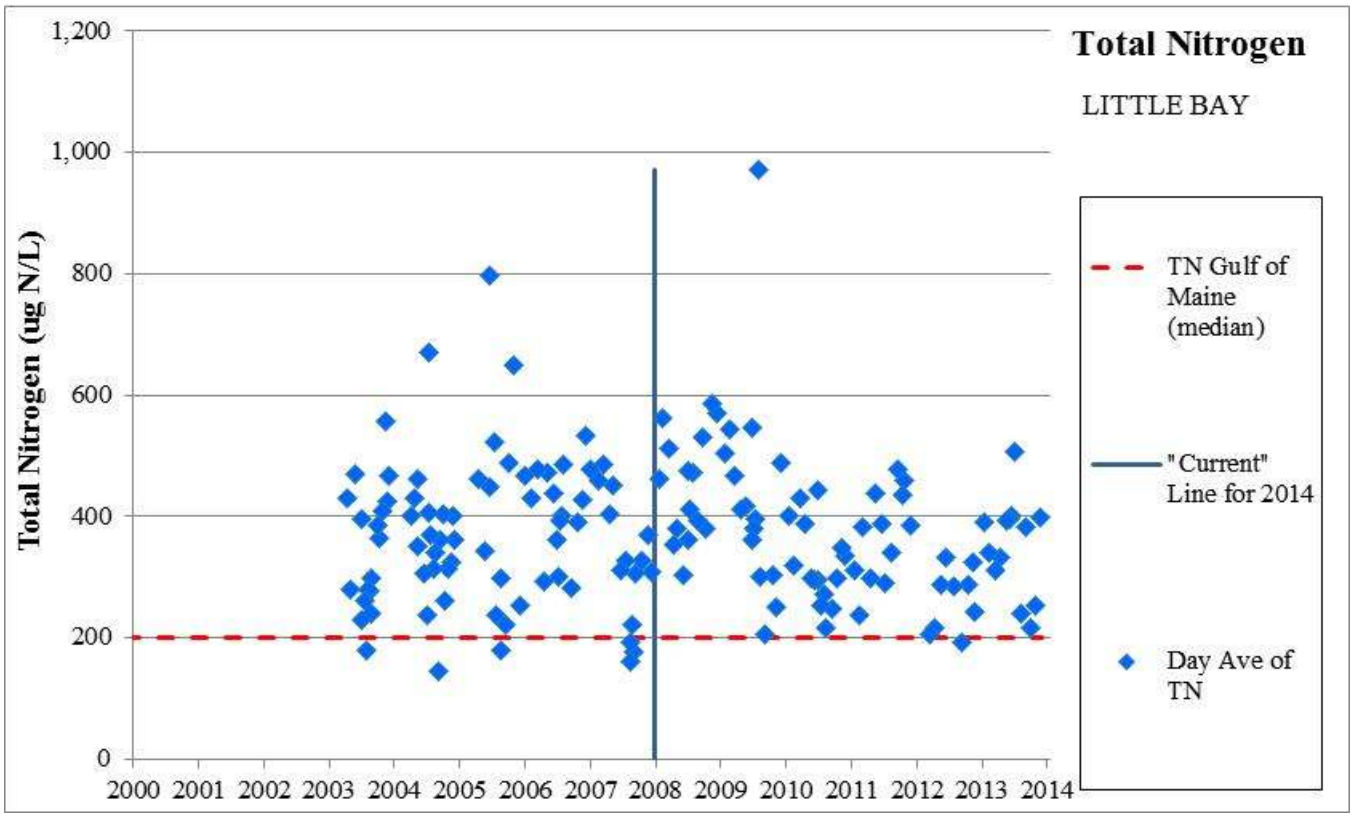

Chlorophyll-a
LITTLE BAY
ug Chl-a / L
30
25
20
15
10
5
0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Chl-a Ind. (90th percentile)
"Current" Line for 2014
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN


Dissolved Oxygen Concentration
LITTLE BAY
Dissolved Oxygen, mg / L
16
14
12
10
8
6
4
2
0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2014
DO-PPM-GRAB-CP
DO-PPM-GRAB-NCP


Dissolved Oxygen Percent Saturation
LITTLE BAY
Dissolved Oxygen, Percent Saturation
160
140
120
100
80
60
40
20
0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2014
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP


Light Attenuation
LITTLE BAY
Kd 1 / m (PAR) (lower is better)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Survival Min. Ind. (median)
"Current" Line for 2014
LIGHT ATTENUATION COEFFICIENT


Eelgrass Cover in Little Bay
Cover (acres)
60
50
40
30
20
10
0
1990
1995
2000
2005
2010
2015
Year
No statistically significant trend
Cover (UNH)
Trend
Kappa/Barker

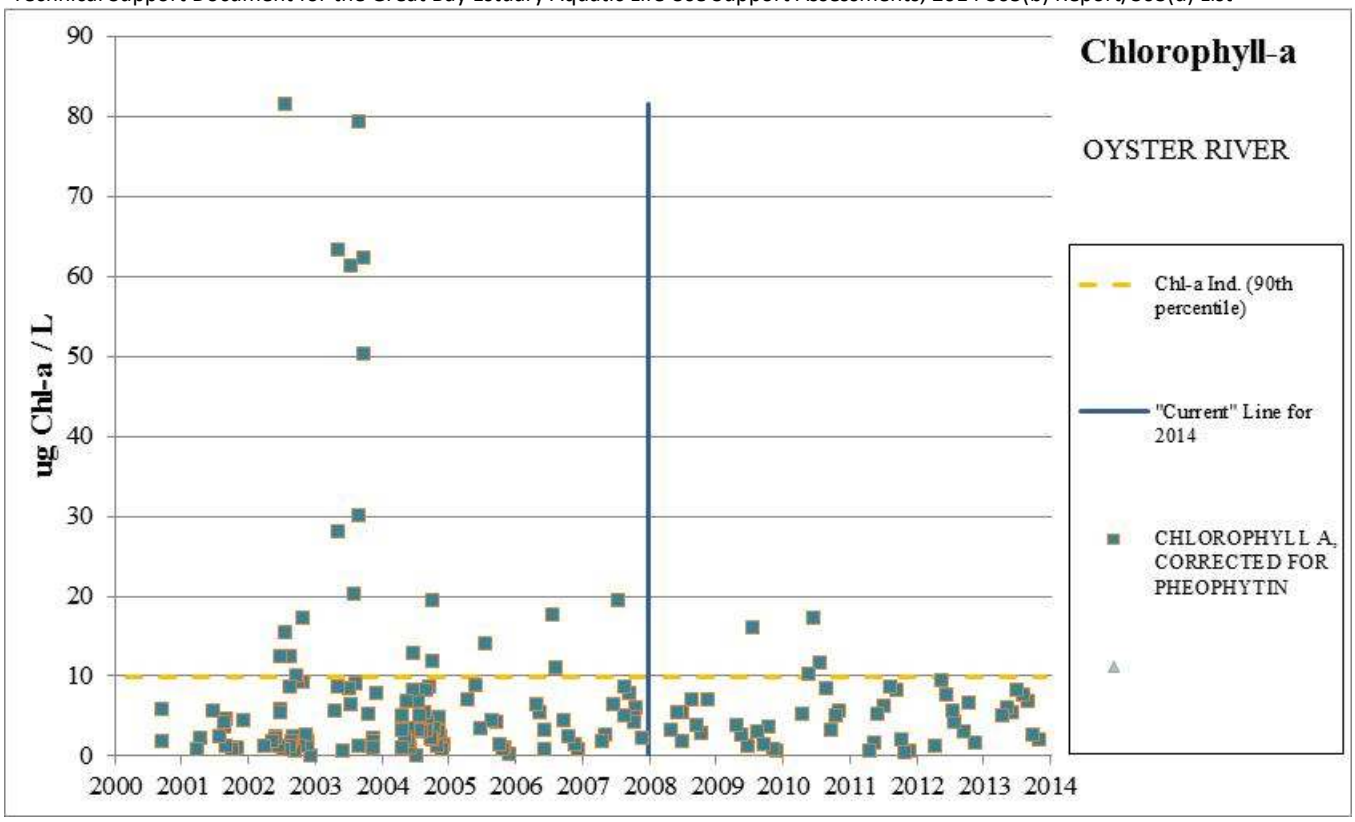

Total Nitrogen
LITTLE BAY
Total Nitrogen (ug N/L)
1,200
1,000
800
600
400
200
0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
TN Gulf of Maine (median)
"Current" Line for 2014
Day Ave of TN

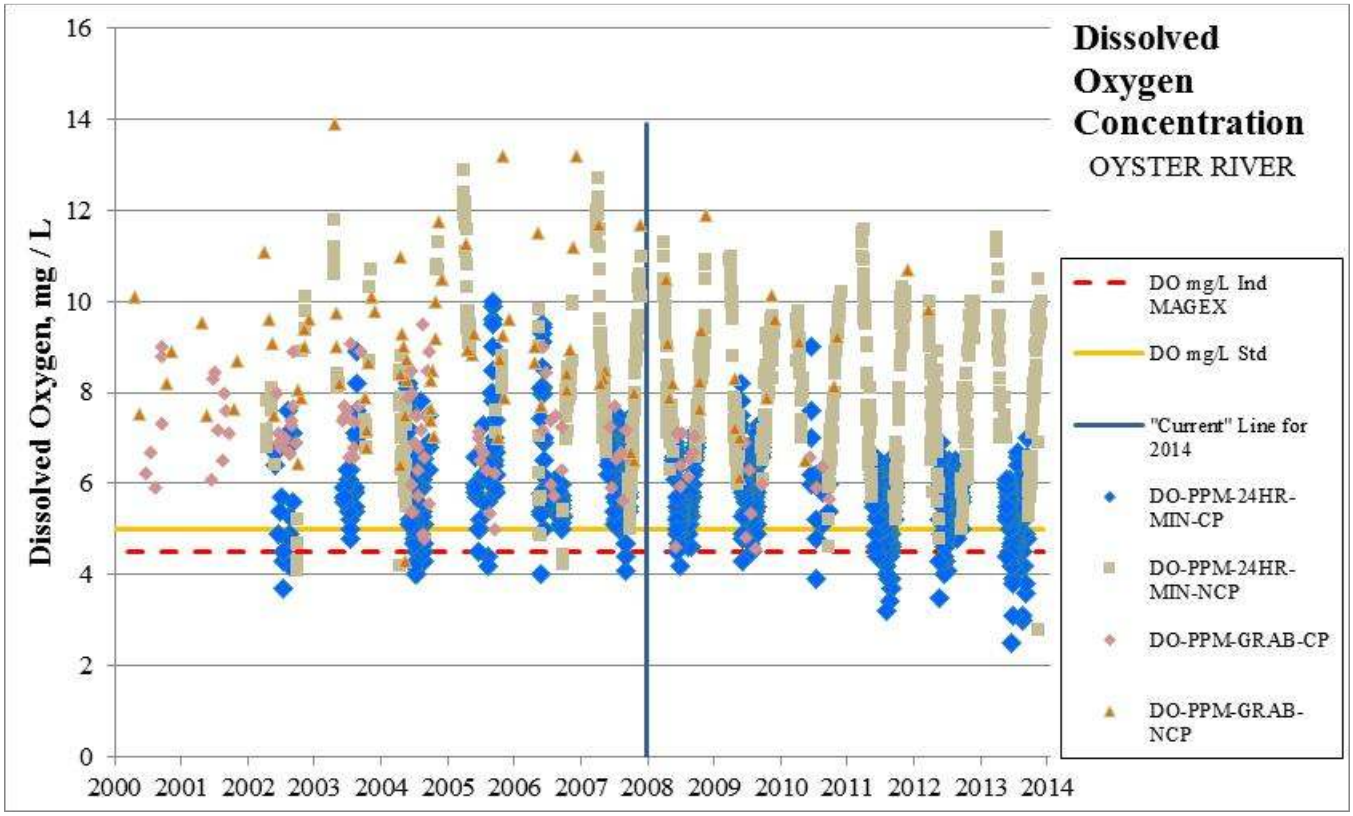
Little Bay Assessment Zone (January 1, 2008 to November 7, 2014)	**Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	95	0.4	2.9	**8.9**	16.5
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	-	-	-	-	-
CHLOROPHYLL A, combined	95	0.4	2.9	8.9	16.5
DO-PERC-24H-MEAN-CP	-	-	-	-	-
DO-PERC-24H-MEAN-NCP	-	-	-	-	-
DO-PERC-2TIDE-GRAB-CP	31	74.8	94.9	102.8	113.4
DO-PERC-2TIDE-GRAB-NCP	60	79.2	95.5	109.2	118.9
DO-PPM-24HR-MIN-CP	-	-	-	-	-
DO-PPM-24HR-MIN-NCP	-	-	-	-	-
DO-PPM-GRAB-CP	58	5.3	7.1	7.9	8.7
DO-PPM-GRAB-NCP	65	7.4	9.5	12.8	14.3
LIGHT ATTENUATION COEFFICIENT	60	0.562	**0.948**	1.613	2.480
TURBIDITY	-	-	-	-	-
Day Ave of TN	79	194	**379**	512	971
Day Ave of TDN	84	130	282	413	876
Day Ave of DIN (NH3 + NO2/3)	83	5	135	217	372
Day Ave of NH3	83	3	40	91	178
Day Ave of PON	14	9	50	78	86
Day Ave of NO2/3	84	3	73	166	242

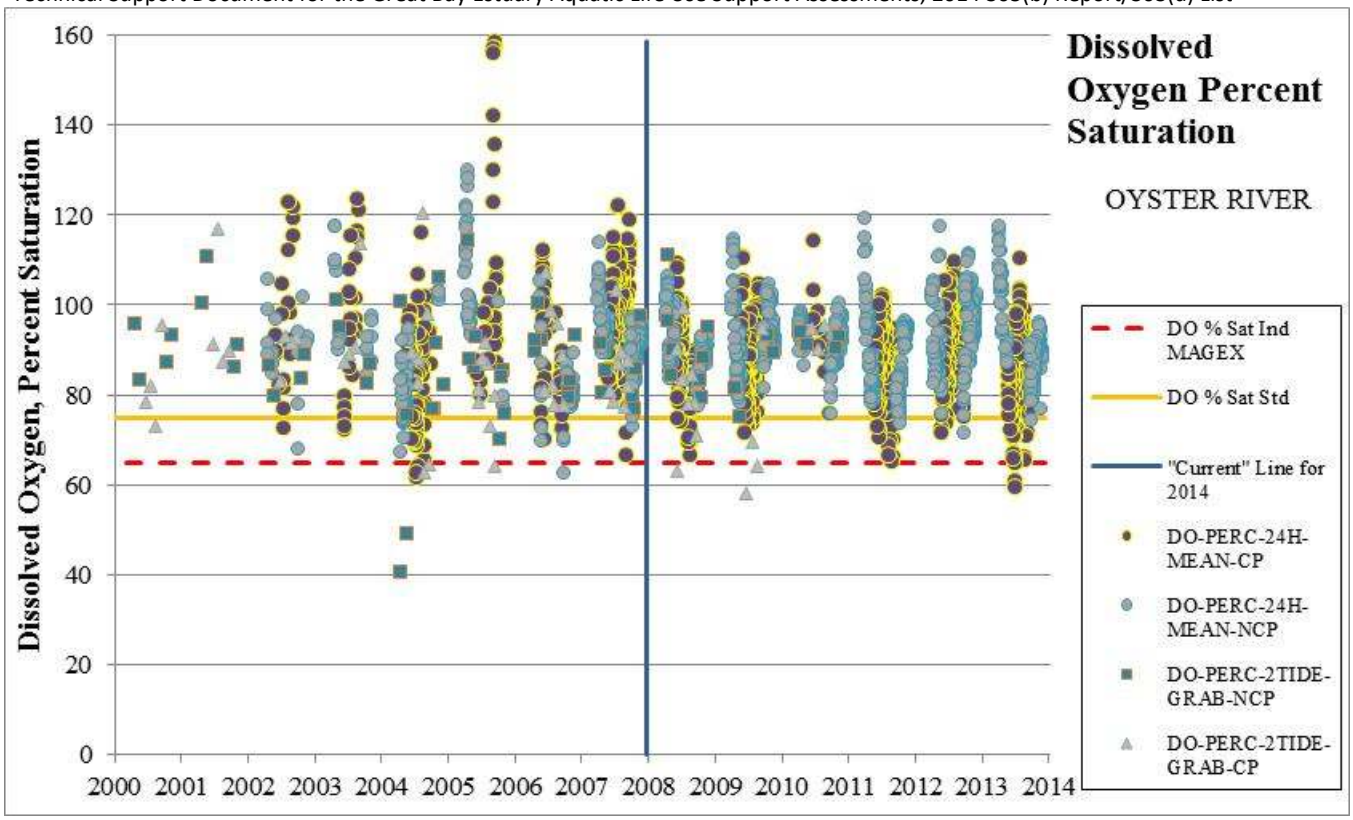
Assessment Zone = OYSTER RIVER

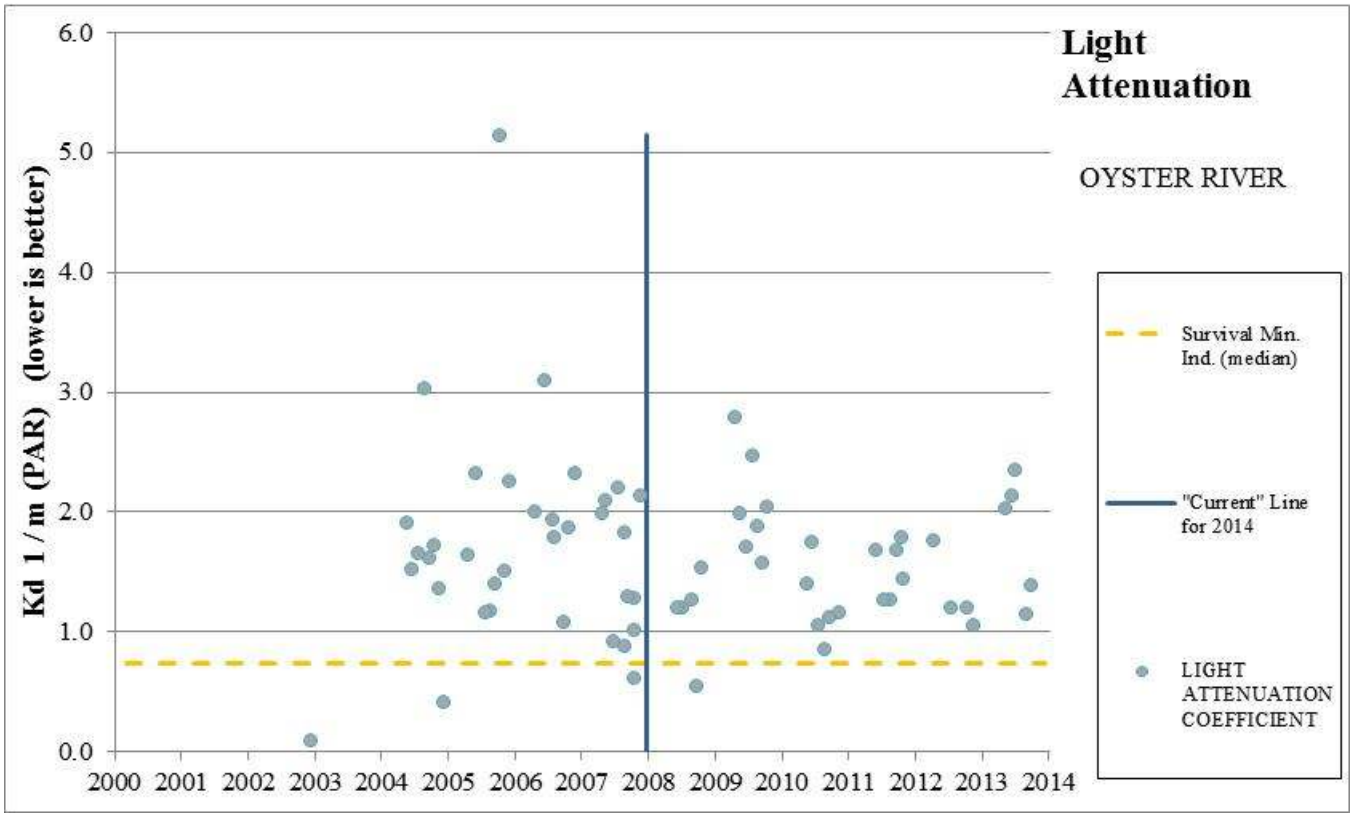
(NHEST600030902-01-03, NHEST600030904-06-17)

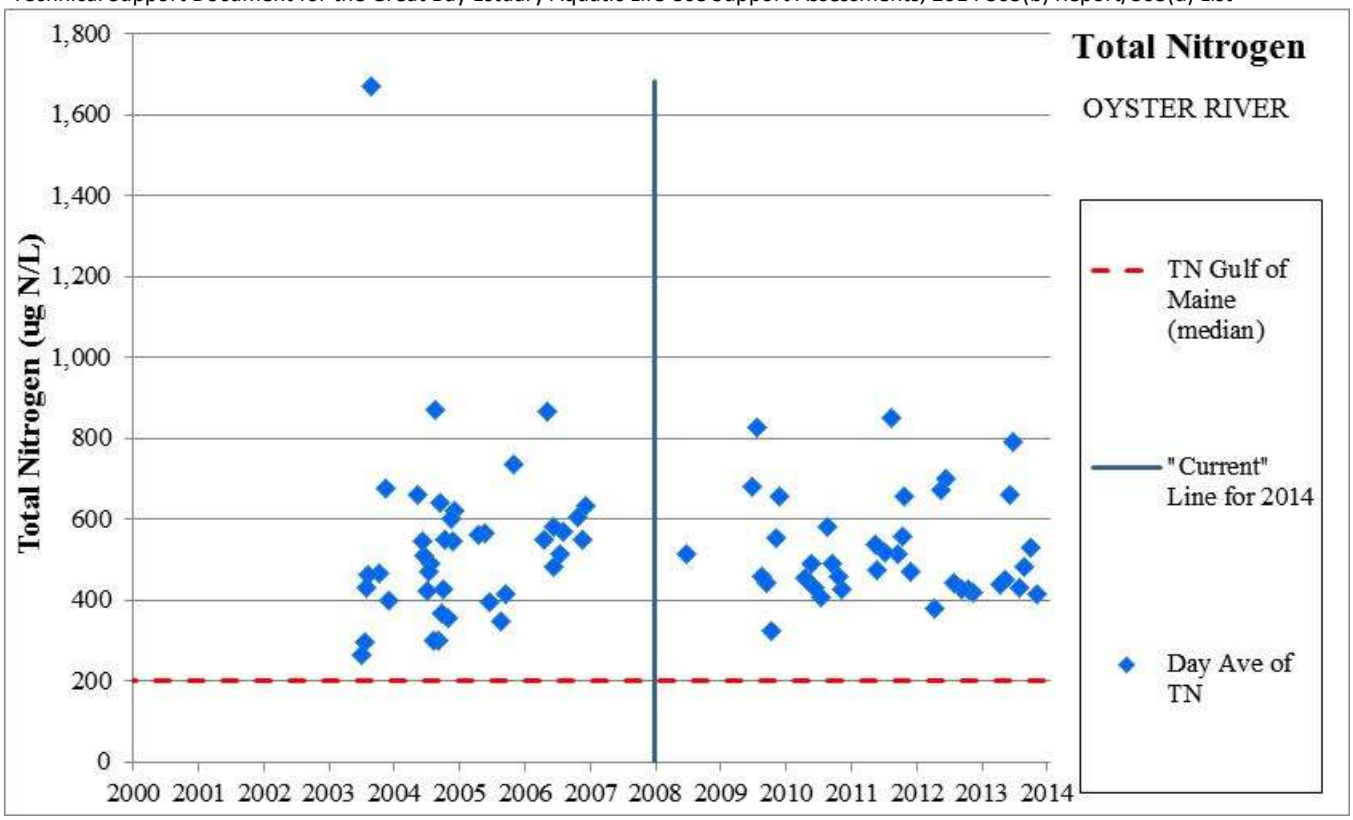
Indicator	Aquatic Life Use Category 2012 / 2014	2014
Chlorophyll-a	5-M / 5M	The calculated 90th percentile chlorophyll-a in this assessment zone is 9.4 ug/L (n = 50) and a maximum reading of 17.3 ug/L. The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L. While the maximum chlorophyll-a concentrations appear to be improving and the indicator now falls below the indicator threshold, there are still frequent dissolved oxygen concentration and percent saturation criteria exceedences. Until those exceedences are curtailed the chlorophyll-a impairment determination remains.
Dissolved Oxygen (mg/L)	5-P /5-P	Dissolved oxygen concentration measurements in this assessment zone fall below the 5 mg/L criteria every year. In most years a portion of those measurements fall below 4 mg/L and in some years below 3 mg/L, therefore this impairment is considered severe.
Dissolved Oxygen (% Saturation)	5-M /5-P	Dissolved oxygen 24 hour average percent saturation measurements in this assessment zone fall below the 75 percent criteria nearly every year. In many years a portion of those measurements fall below 65 percent, therefore this impairment is considered severe.
Estuarine Bioassessments (eelgrass)	5-P /5-P	The historical extent of eelgrass in this assessment zone was 182.5 acres from the 1948 dataset. Some of eelgrass was found in 1996 (14 acres). The median current extent of eelgrass in 2011-2013 is 0 acres, which is a decrease of 100%. Since 1990, the trend in eelgrass cover in this assessment zone could not be determined because the eelgrass cover has been zero for most years since 1981. The thresholds for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	5-P /5-P	Median=1.460 m^-1 (n=33). For an eelgrass restoration depth of 2 m, the light attenuation coefficient threshold is 0.75 m^-1. Most of the recent historic mapping show eelgrass principally in the shallow areas. Older datasets had eelgrass growing in both the shallow and deeper habitat. The potential for the deeper habitat and the improved restoration potential provided by improved water clarity make the 2m restoration depth a valid target. Therefore, the impaired (5-P) listing from the 2012 303d list has been retained.
Total Nitrogen	5-P /5-P	The median total nitrogen from 2008 through 2013 was 482 ug/L (n=39). New Hampshire is no longer comparing ambient total nitrogen data to the total nitrogen numeric indicators used in the 2012 assessment as translators for the narrative water quality criteria. This assessment zone experiences frequent dissolved oxygen concentrations well below 5 mg/L and at times below 3 mg/L. The daily average dissolved oxygen percent saturation falls below 75 percent nearly every year and at times below 65 percent. During multiple years this assessment zone has also demonstrated super saturation over 125% including peak saturations of 145% (2013), 151% (2012), 141% (2011), and 144% (2008). The chlorophyll-a concentration 90th percentile was 9.4 (n=50) from 2008 through 2013. The eelgrass beds are degraded and the available light attenuation (median=1.460 m^-1 (n=33)) is poor. The nearest POTW discharge is actively ratcheting down their nitrogen discharge but at this time many of the classic indicators of nutrient eutrophication are present in this assessment zone. As such, the impairment for nitrogen has been retained.


Chlorophyll-a
OYSTER RIVER
ug Chl-a / L
0
10
20
30
40
50
60
70
80
90
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Chl-a Ind. (90th percentile)
"Current" Line for 2014
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN


Dissolved Oxygen Concentration
OYSTER RIVER
Dissolved Oxygen, mg / L
0
2
4
6
8
10
12
14
16
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2014
DO-PPM-24HR-MIN-CP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP
DO-PPM-GRAB-NCP


Dissolved Oxygen Percent Saturation
OYSTER RIVER
Dissolved Oxygen, Percent Saturation
160
140
120
100
80
60
40
20
0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2014
DO-PERC-24H-MEAN-CP
DO-PERC-24H-MEAN-NCP
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP


Light Attenuation
OYSTER RIVER
Kd 1 / m (PAR) (lower is better)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Survival Min. Ind. (median)
"Current" Line for 2014
LIGHT ATTENUATION COEFFICIENT

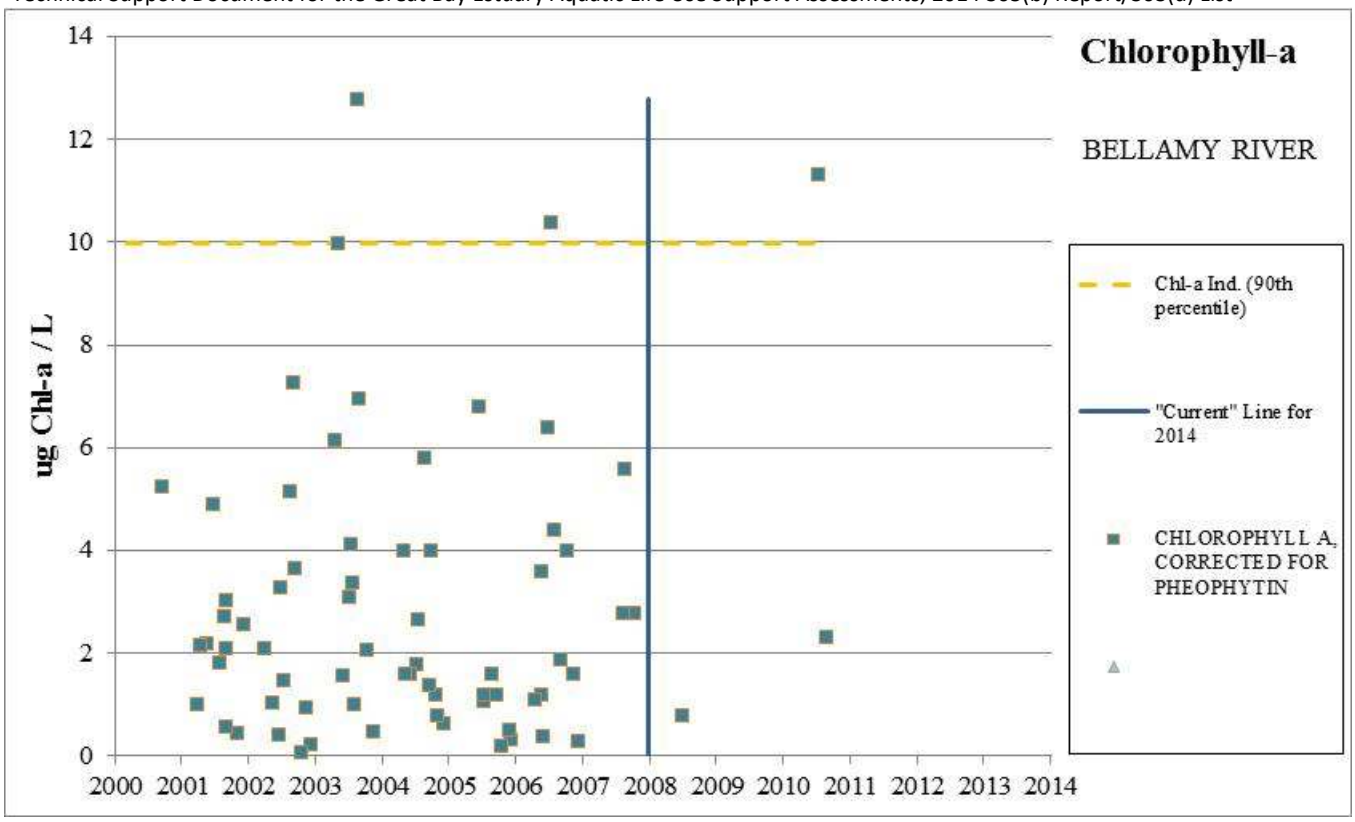


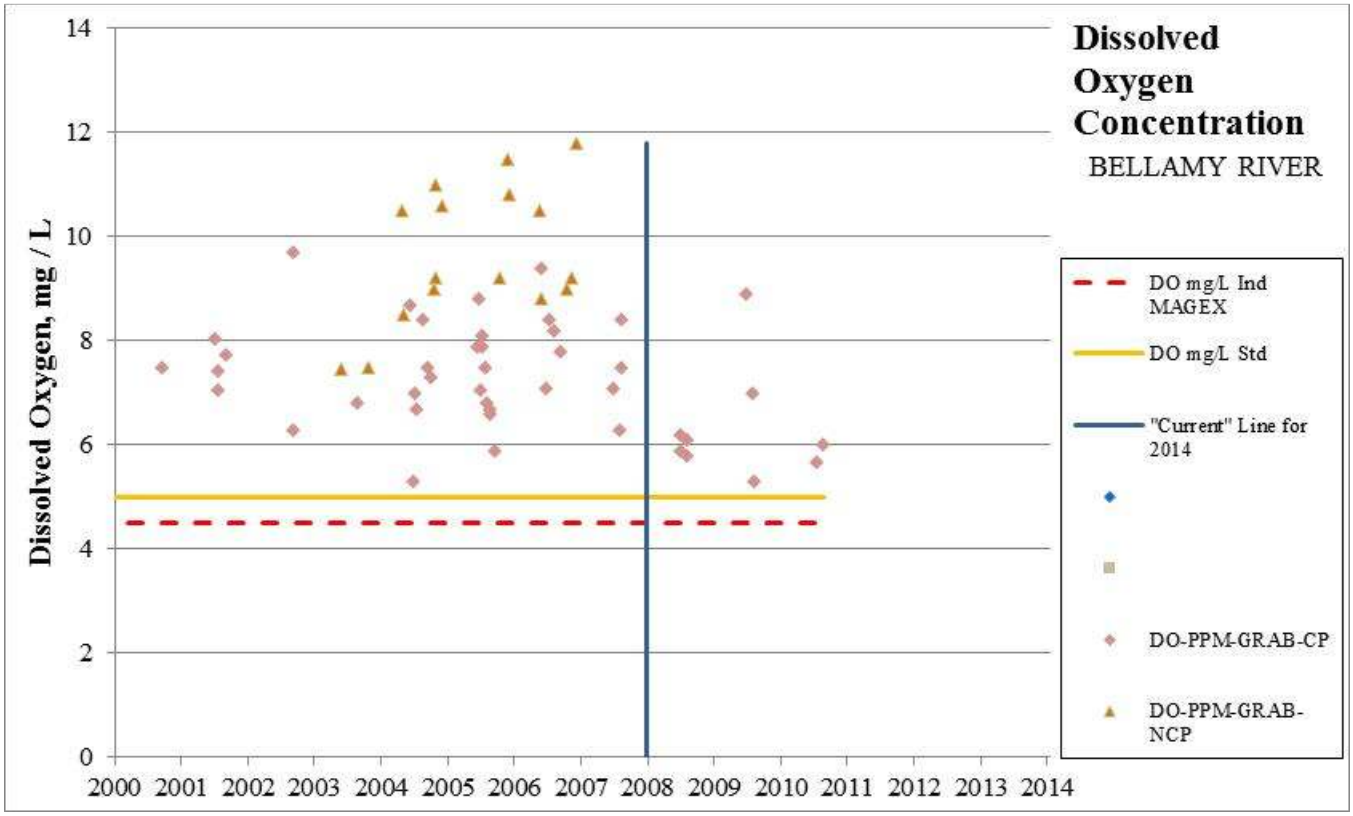
Oyster River Assessment Zone (January 1, 2008 to November 7, 2014)	Count	Minimum	Median	90th Percentile	Maximum
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	50	0.5	5.1	**9.4**	17.3
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	-	-	-	-	-
CHLOROPHYLL A, combined	50	0.5	5.1	9.4	17.3
DO-PERC-24H-MEAN-CP	560	59.7	87.3	100.0	114.4
DO-PERC-24H-MEAN-NCP	671	71.7	91.5	102.8	119.3
DO-PERC-2TIDE-GRAB-CP	16	58.3	82.8	96.7	99.6
DO-PERC-2TIDE-GRAB-NCP	16	75.2	90.4	101.1	111.2
DO-PPM-24HR-MIN-CP	572	2.5	5.7	6.6	9.0
DO-PPM-24HR-MIN-NCP	675	2.8	8.1	9.9	11.6
DO-PPM-GRAB-CP	19	4.6	6.3	7.1	7.1
DO-PPM-GRAB-NCP	21	6.1	8.3	10.7	11.9
LIGHT ATTENUATION COEFFICIENT	33	0.560	**1.460**	2.276	2.810
TURBIDITY	1,393	2.0	52.0	528.6	2,553.0
Day Ave of TN	39	324	**482**	702	850
Day Ave of TDN	52	186	363	577	708
Day Ave of DIN (NH3 + NO2/3)	52	41	199	313	490
Day Ave of NH3	52	13	64	124	213
Day Ave of PON	-	-	-	-	-
Day Ave of NO2/3	52	4	116	215	340

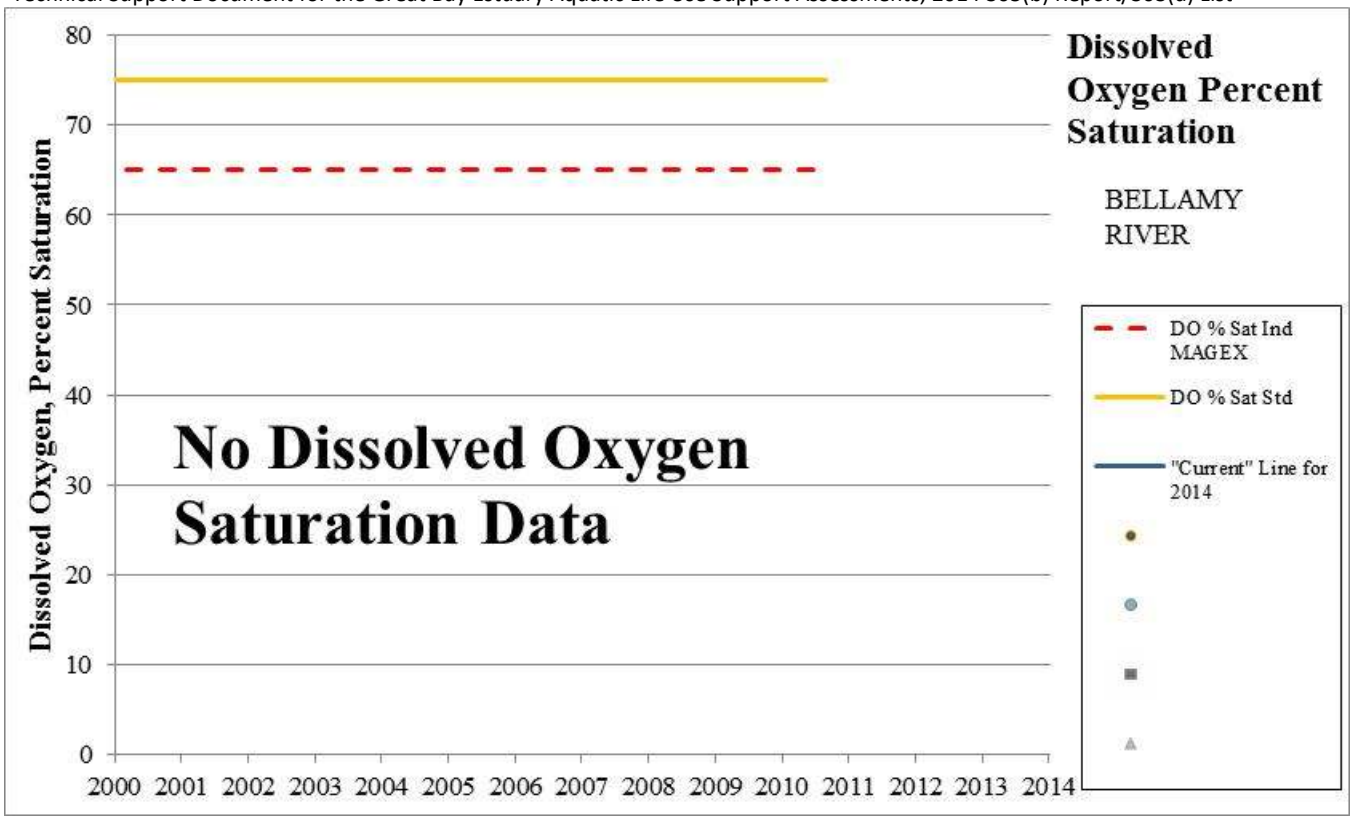
Assessment Zone = BELLAMY RIVER

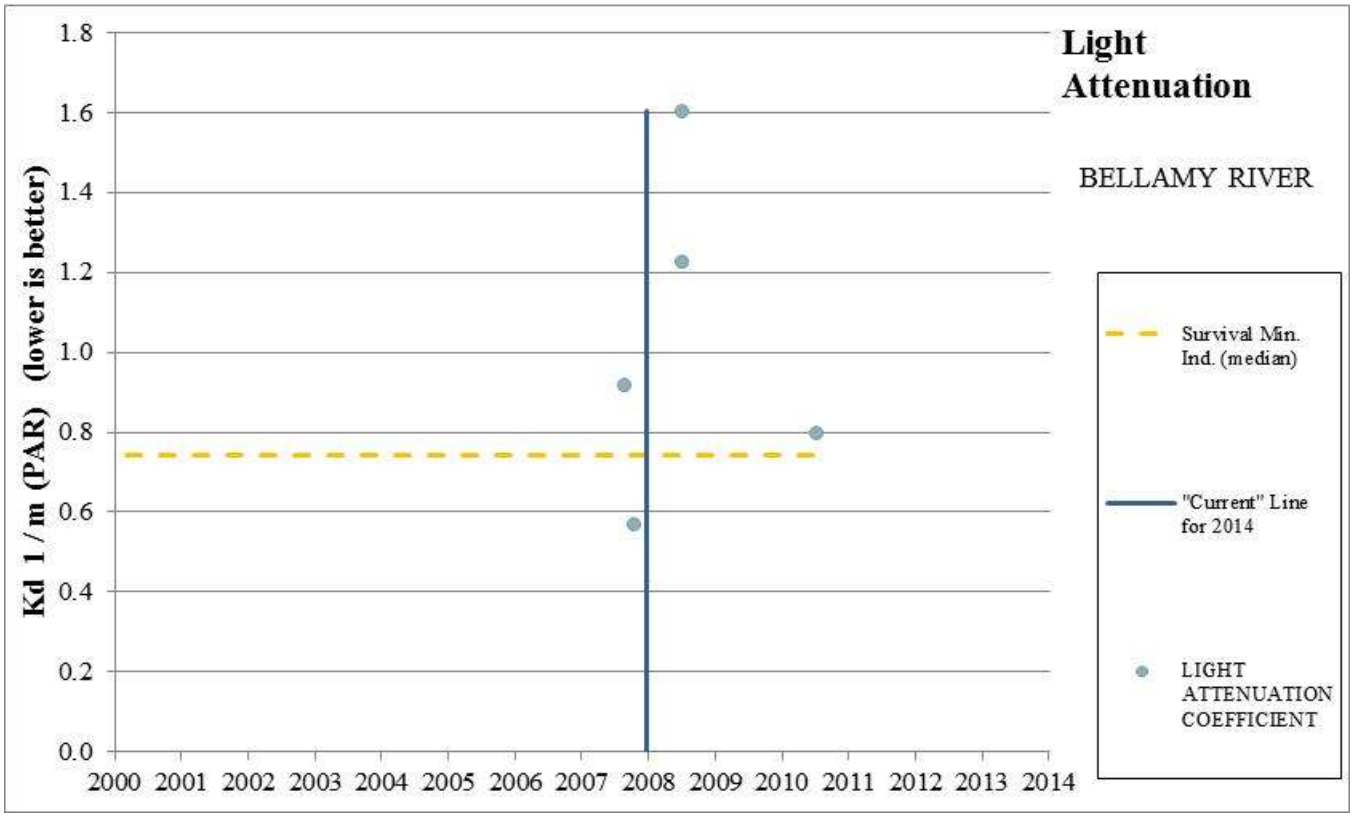
(NHEST600030903-01-01, NHEST600030903-01-03, NHEST600030903-01-04)

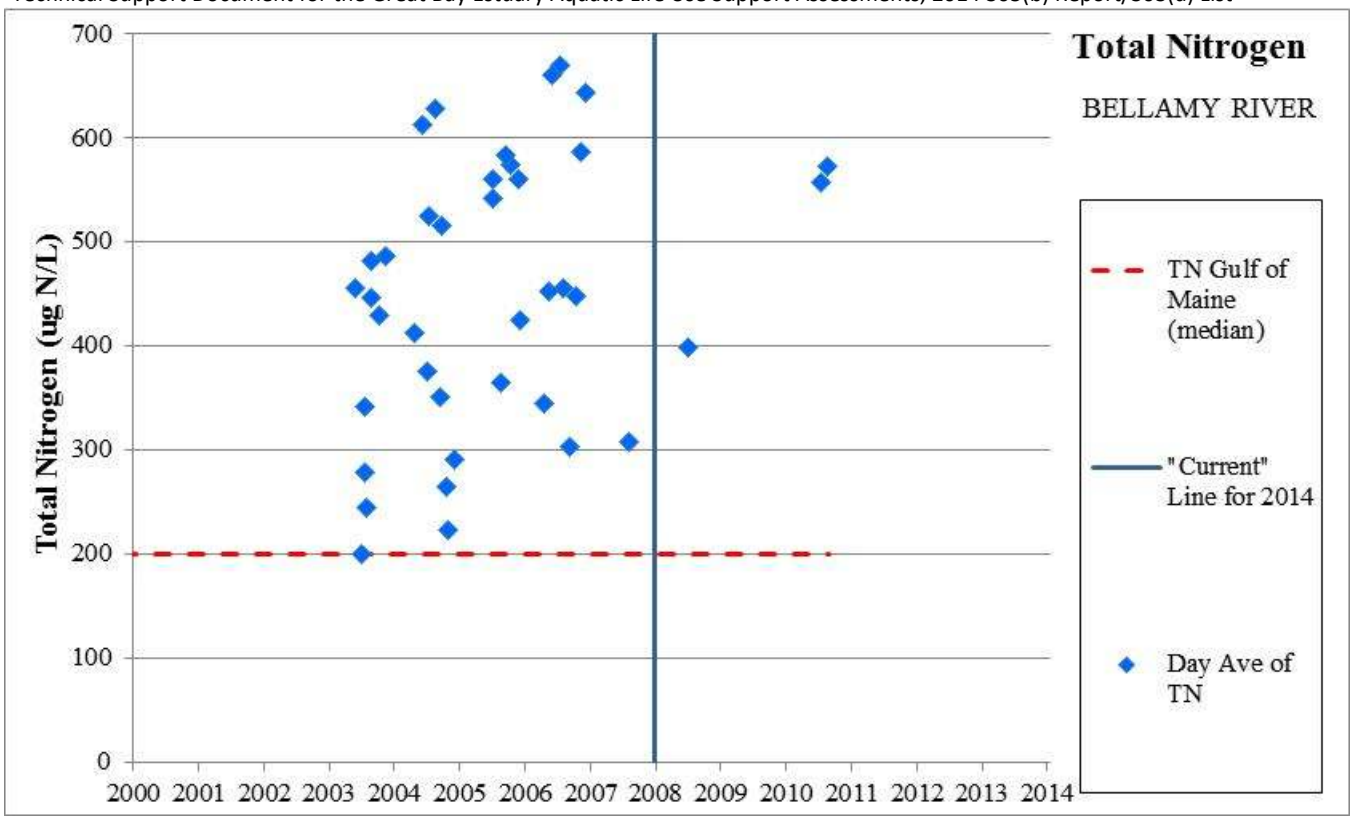
Indicator	Aquatic Life Use Category 2012 / 2014	2014
Chlorophyll-a	2-M / 3-PNS	The calculated 90th percentile chlorophyll-a in this assessment zone cannot be calculated due to the presence of only three measured values since 2008 (0.8, 2.3, and 11.4 ug/L). The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L. The limited available data leads to an assessment of Insufficient Information – Potentially Not Supporting.
Dissolved Oxygen (mg/L)	2-G / 3-PAS	This assessment zone has only grab sample measurements for dissolved oxygen concentration and those measurements were only collected up through 2010. That available data indicates that this assessment zone meets the dissolved oxygen criteria but there are insufficient samples to assess the waterbody as fully supporting.
Dissolved Oxygen (% Saturation)	3-ND / 3-ND	This assessment zone has no measurements for dissolved oxygen percent saturation.
Estuarine Bioassessments (eelgrass)	5-P / 5-P	The historical extent of eelgrass in this assessment zone was 66.9 acres from the 1948, 1962, 1980, and 1981 datasets. Some eelgrass was found in 2004 (0.8 acres). The median current extent of eelgrass in 2011-2013 is 0 acres, which is a decrease of 100%. Since 1990, the trend in eelgrass cover in this assessment zone could not be determined because the eelgrass cover has been zero for most years since 1981. The thresholds for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	3-PNS / 3-PNS	Median=1.235 m^-1 (n=3). For an eelgrass restoration depth of 2 m, the light attenuation coefficient threshold is 0.75 m^-1. Therefore, the insufficient information – potentially not supporting (3-PNS) assessment from the 2012 305(b) list has been retained.
Total Nitrogen	5-P / 3-PNS	The median total nitrogen from the very limited 2008 through 2013 data was 557 ug/L (n=3). New Hampshire is no longer comparing ambient total nitrogen data to the total nitrogen numeric indicators used in the 2012 assessment as translators for the narrative water quality criteria. The limited current grab samples for dissolved oxygen concentration (2008 - 2010) indicate that this assessment zone meets the water quality criteria. However, there are no data to evaluate dissolved oxygen percent saturation. The scarcity of data for this assessment zone is also reflected in the three chlorophyll-a samples collected from 2008 through 2013. While there are only three light attenuation measurements from 2008 through 2013 they were 0.807, 1.235, and 1.613 m^-1, all of which are indicative of poor light transmittance. Eelgrass has been absent from this assessment zone since 1981 with small reoccurrence in 2004 (0.8 acres). No sampling efforts have taken place to evaluate the extent of epiphytes and macrophytes. This assessment zone is generally characterized by its lack of eutrophication indicator data. There are not sufficient datasets to determine that eutrophication by total nitrogen is alone is not known to be strong enough to warrant impairment under New Hampshire's narrative standard. As such, this assessment zone has been assessed as Insufficient Information – Potentially Not Supporting (3-PNS) for total nitrogen.


Chlorophyll-a
BELLAMY RIVER
ug Chl-a / L
0
2
4
6
8
10
12
14
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Chl-a Ind. (90th percentile)
"Current" Line for 2014
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN


Dissolved Oxygen Concentration
BELLAMY RIVER
Dissolved Oxygen, mg / L
0
2
4
6
8
10
12
14
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2014
DO-PPM-GRAB-CP
DO-PPM-GRAB-NCP


Dissolved Oxygen Percent Saturation
BELLAMY RIVER
Dissolved Oxygen, Percent Saturation
No Dissolved Oxygen Saturation Data
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2014
0
10
20
30
40
50
60
70
80
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014


Light Attenuation
BELLAMY RIVER
Kd 1 / m (PAR) (lower is better)
Survival Min. Ind. (median)
"Current" Line for 2014
LIGHT ATTENUATION COEFFICIENT
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014



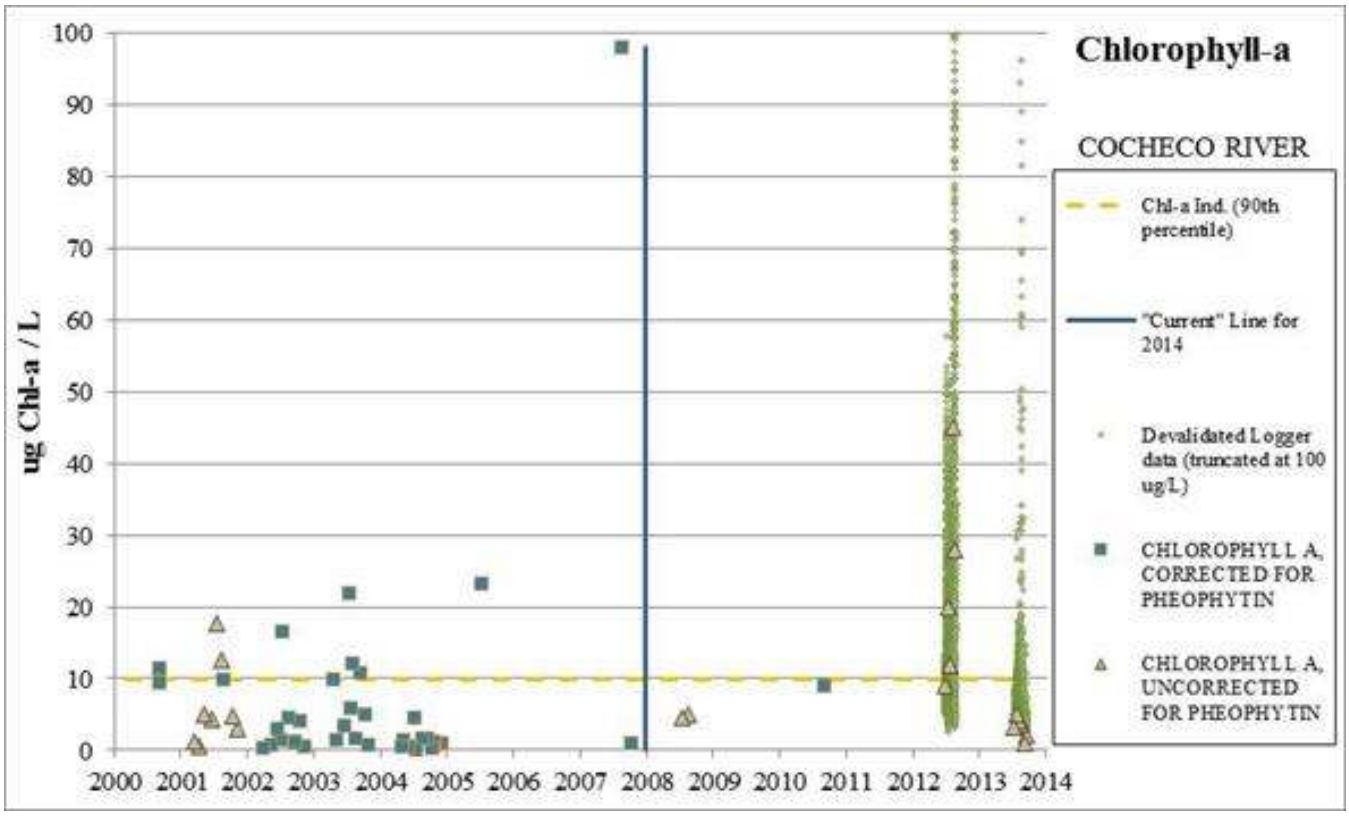
Bellamy River Assessment Zone (January 1, 2008 to November 7, 2014)	**Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	3	0.8	2.3	-	11.34
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	-	-	-	-	-
CHLOROPHYLL A, combined	3	0.8	2.3	-	11.34
DO-PERC-24H-MEAN-CP	-	-	-	-	-
DO-PERC-24H-MEAN-NCP	-	-	-	-	-
DO-PERC-2TIDE-GRAB-CP	-	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP	-	-	-	-	-
DO-PPM-24HR-MIN-CP	-	-	-	-	-
DO-PPM-24HR-MIN-NCP	-	-	-	-	-
DO-PPM-GRAB-CP	9	5.3	6.0	8.9	8.90
DO-PPM-GRAB-NCP	-	-	-	-	-
LIGHT ATTENUATION COEFFICIENT	3	0.807	**1.235**	-	1.613
TURBIDITY	-	-	-	-	-
Day Ave of TN	3	398	**557**	-	573
Day Ave of TDN	3	287	310	-	527
Day Ave of DIN (NH3 + NO2/3)	3	21	91	-	159
Day Ave of NH3	3	10	46	-	123
Day Ave of PON	2	30	147	-	263
Day Ave of NO2/3	3	11	36	-	45

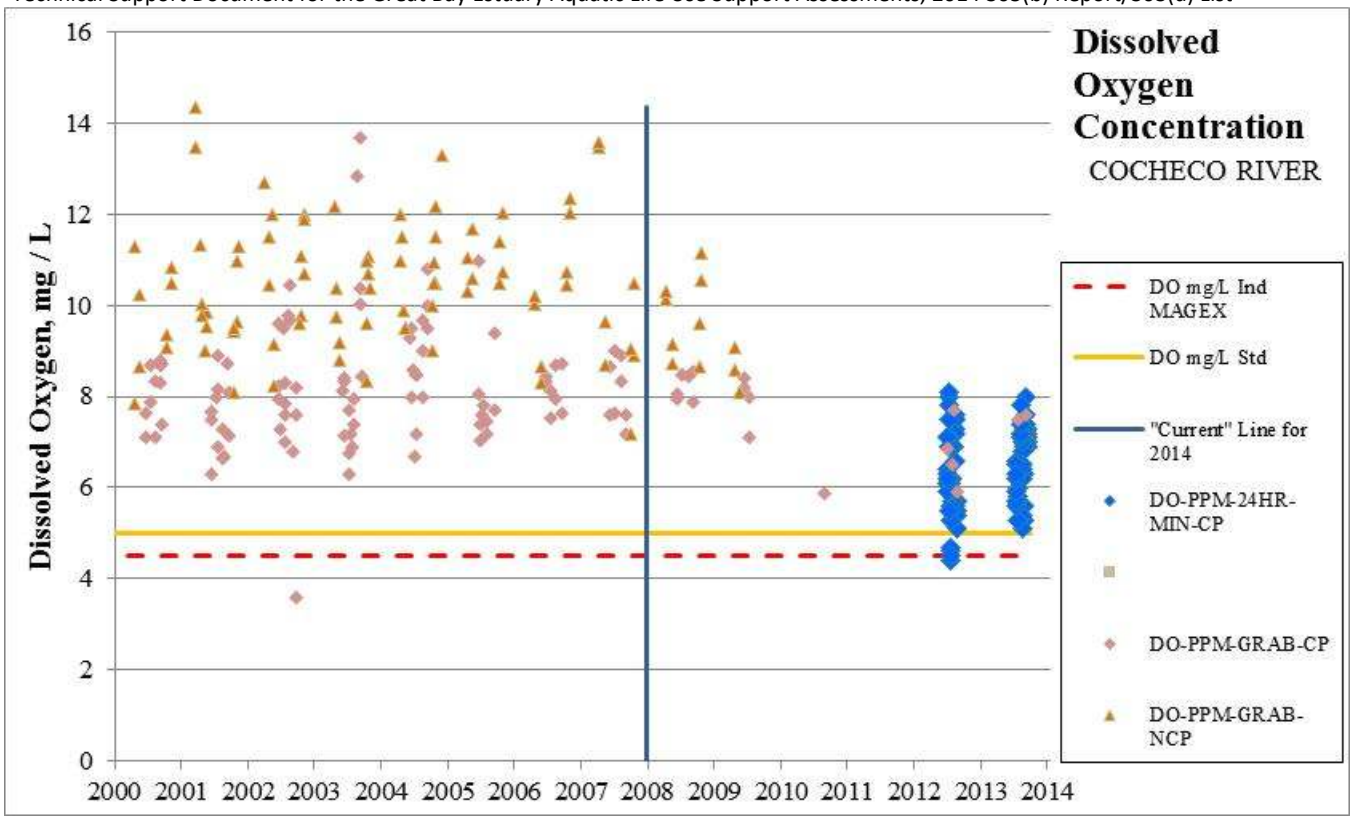
Assessment Zone = COCHECO RIVER

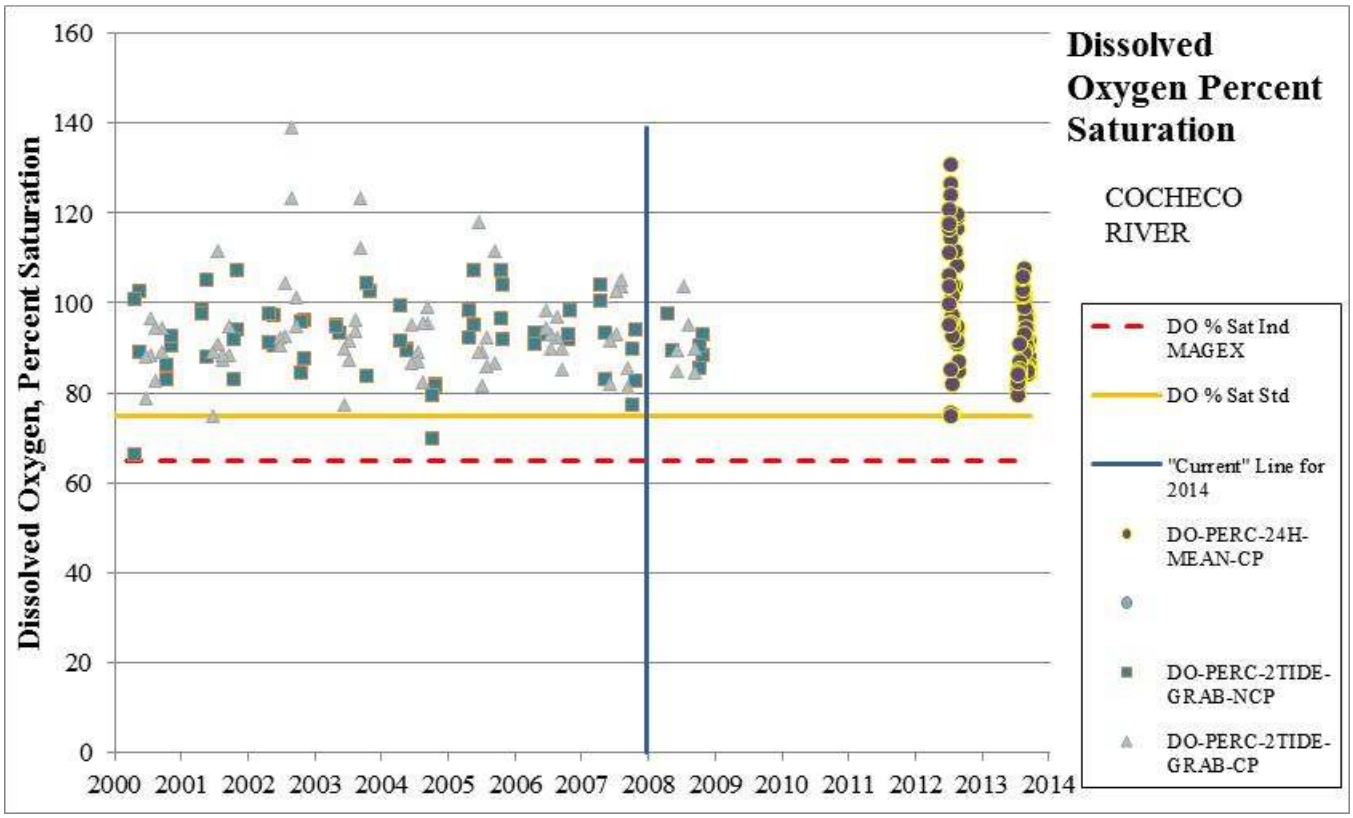
(NHEST600030608-01)

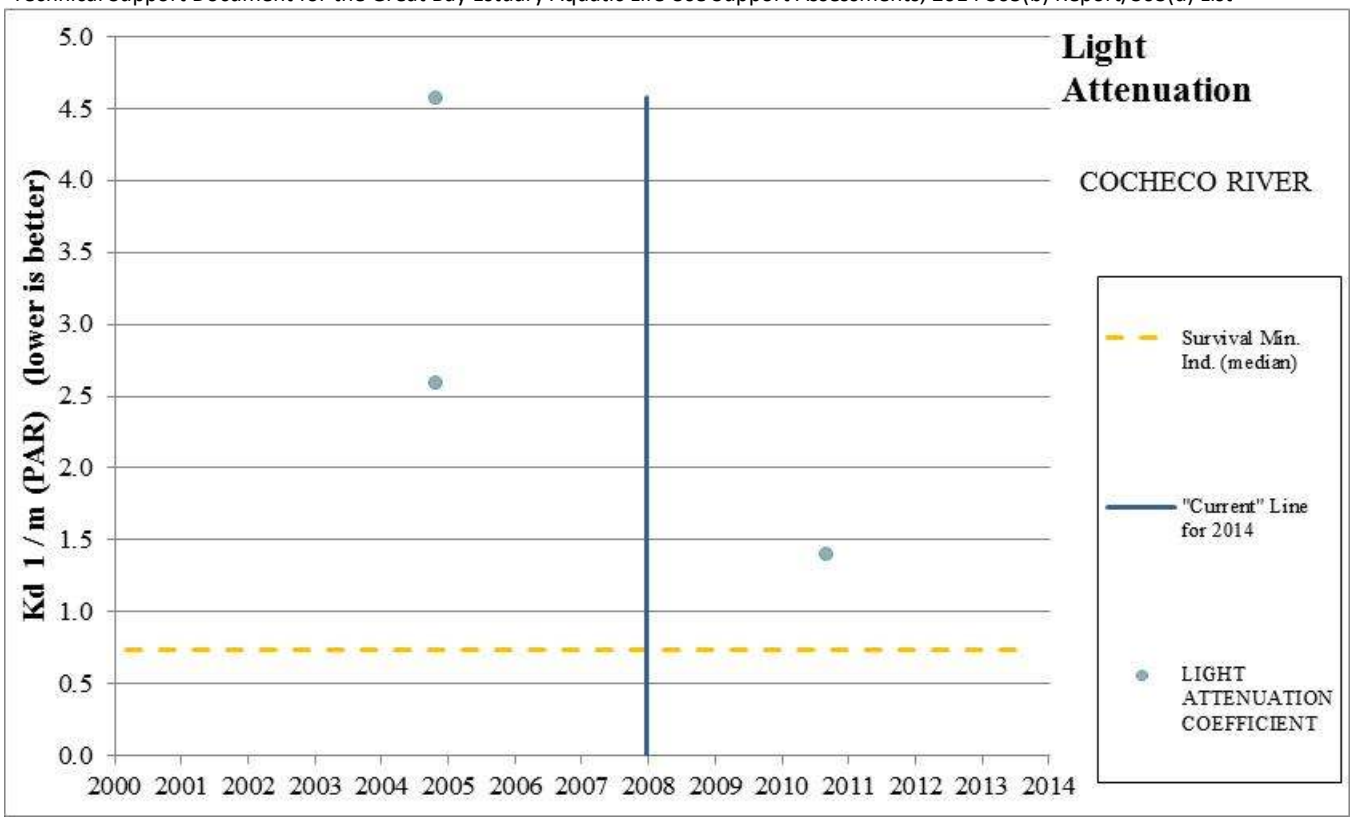
Indicator	Aquatic Life Use Category 2012 / 2014	2014
Chlorophyll-a	5-M / 5-P	The calculated 90th percentile chlorophyll-a in this assessment zone is 36.5 ug/L (n = 14) and a maximum reading of 45 ug/L. The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L. Although the probe based chlorophyll-a data (not used in the median above) collected from station CR1 (2012) was qualified as "estimated" per EPA, due to poor correlation between probe and extracted chlorophyll-a grab sample data, the relative biomass is valid and shows severe spikes in chlorophyll-a. Those spikes were most pronounced when low tide (maximum freshwater signal and maximum water temperature) occurred at midday to late afternoon (maximum photosynthesis duration period) and when freshwater inflow was at a minimum (0.23 – 0.10 cfsm) (minimum dilution of upstream loading). Under those conditions, the high nutrient water sloshing back and forth in the Cocheco River had the optimum conditions to sustain a large phytoplankton biomass.
Dissolved Oxygen (mg/L)	3-PAS / 3-PNS	Following the 10% method listed in the 2014 CALM, this parameter would be categorized as 2-M. Part of the concept behind the 10% rule was to address random errors within the meter measurement accuracy thereby limiting accidental impairments. The magnitude of exceedence indicator was layered into the assessment process to address major exceedences and exceedences beyond all normal measurement errors. In the case of this assessment zone there are 102 station/days of datalogger DO readings during the critical summer period. Only some of that time would be considered most limiting condition. The datalogger deployment in 2012 at station CR3 had several days of the deployment during which the dissolved oxygen concentration dipped below 5 mg/L. Those excursions had similar characteristics and were most pronounced during the evening occurrences (maximum respiration) of low tides (maximum freshwater signal and maximum water temperature) when freshwater inflow was at a minimum (minimum dilution of upstream loading). The frequency, duration, and magnitude of those dips do not rise to the severity that warrants and impairment. Acknowledging the existing data, this assessment zone is being assessed as potentially not supporting the dissolved oxygen indicator.
Dissolved Oxygen (% Saturation)	3-PAS / 2-M	Dissolved oxygen percent saturation has been assessed using grab samples up through 2010 and via dataloggers in 2012 and 2013. On only one occasion did the 24 hour average percent saturation fall below 75 percent (74.7 percent over July 27, 2012). While the 2012 datalogger deployment at CR1 saw the most severe dissolved oxygen saturation swings and super saturation conditions, the hour average percent saturation only fell below 75 percent on that one date.
Estuarine Bioassessments (eelgrass)	No Std/ No Std	Not applicable. Eelgrass habitat has not historically existed in this assessment zone.
Water Clarity (Light Attenuation Coefficient)	No Std/ No Std	Not applicable. The water clarity has not been assessed because eelgrass has not historically existed in this assessment zone.
Total Nitrogen	5-P / 3-PNS	The median total nitrogen from 2008 through 2013 was 600 ug/L (n=9). New Hampshire is no longer comparing ambient total nitrogen data to the total nitrogen numeric indicators used in the 2012 assessment as translators for the narrative water quality criteria. This assessment zone experiences occasional dissolved oxygen concentrations below 5 mg/L, however, those apparent exceedences are very short in duration and not frequent. The chlorophyll-a concentration 90th percentile was 36.5 ug/L (n = 14) and a maximum reading of 45 ug/L. Although the probe based chlorophyll-a data (not used in the median above) was qualified as "estimated" per EPA, due to poor correlation between probe and extracted chlorophyll-a grab sample data, the relative biomass is valid and demonstrates that chlorophyll-a biomass can be very high depending upon the timing of the tide cycle. For shallow systems, it is expected that changes in macroalgae will

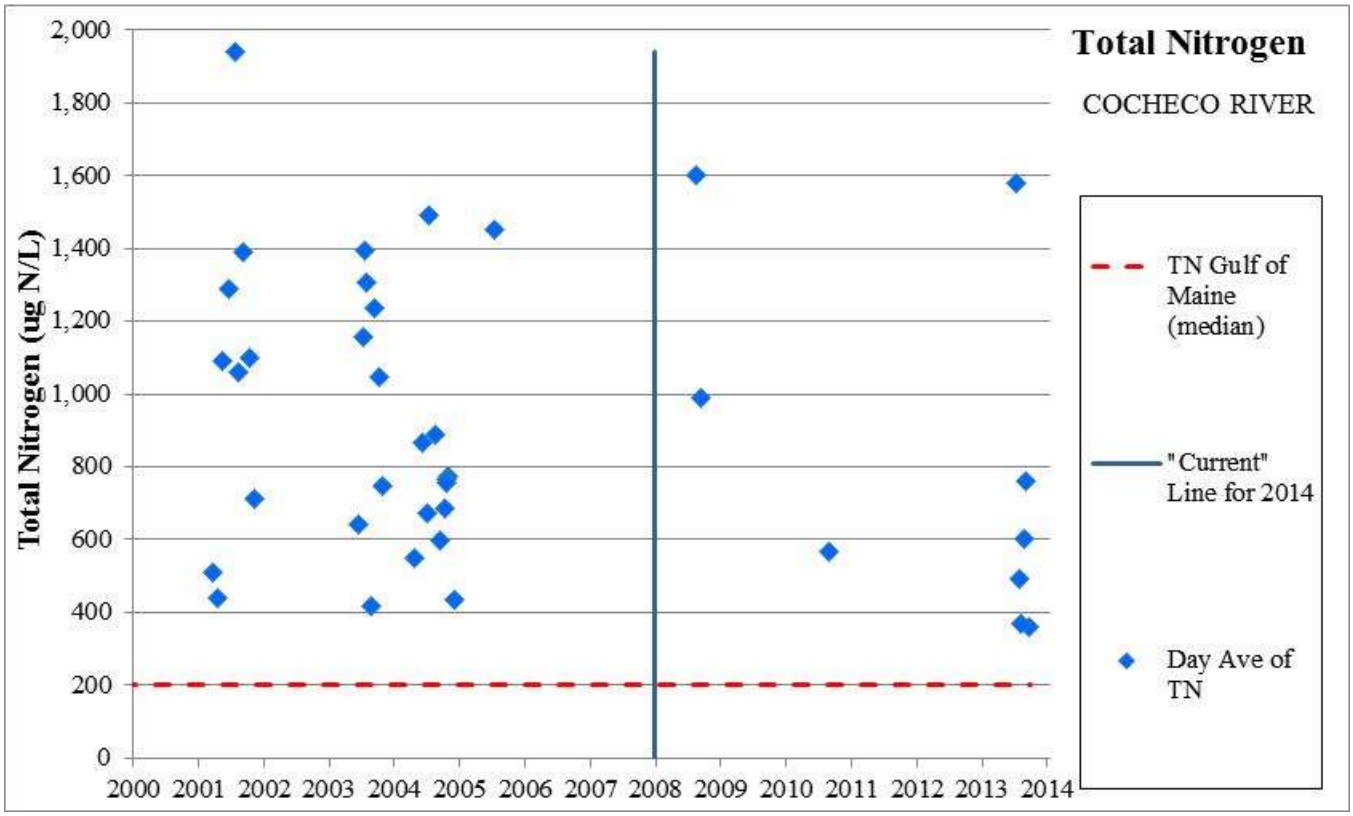
		precede changes in phytoplankton (McGlathery, Sundbäck, & Anderson, 2007) (Valiela, et al., 1997), which appears to be occurring in the Cocheco River. Some of the classic indicators of nutrient eutrophication are present in this assessment zone and total nitrogen remains elevated. As the discussion above illustrates, there is a clear nutrient "signature" in the data. It is less clear, at this time, whether the response datasets demonstrate sufficient power to determine that the eutrophication effects on designated uses can be attributed to total nitrogen alone. Given that uncertainty, impairment is not warranted under New Hampshire's narrative standard. As such, this assessment zone has been assessed as Insufficient Information – Potentially Not Supporting (3-PNS) for total nitrogen.




Dissolved Oxygen Concentration
COCHECO RIVER
Dissolved Oxygen, mg / L
0
2
4
6
8
10
12
14
16
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2014
DO-PPM-24HR-MIN-CP
DO-PPM-GRAB-CP
DO-PPM-GRAB-NCP


Dissolved Oxygen Percent Saturation
COCHECO RIVER
Dissolved Oxygen, Percent Saturation
0
20
40
60
80
100
120
140
160
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2014
DO-PERC-24H-MEAN-CP
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP


Light Attenuation
COCHECO RIVER
Kd 1 / m (PAR) (lower is better)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Survival Min. Ind. (median)
"Current" Line for 2014
LIGHT ATTENUATION COEFFICIENT

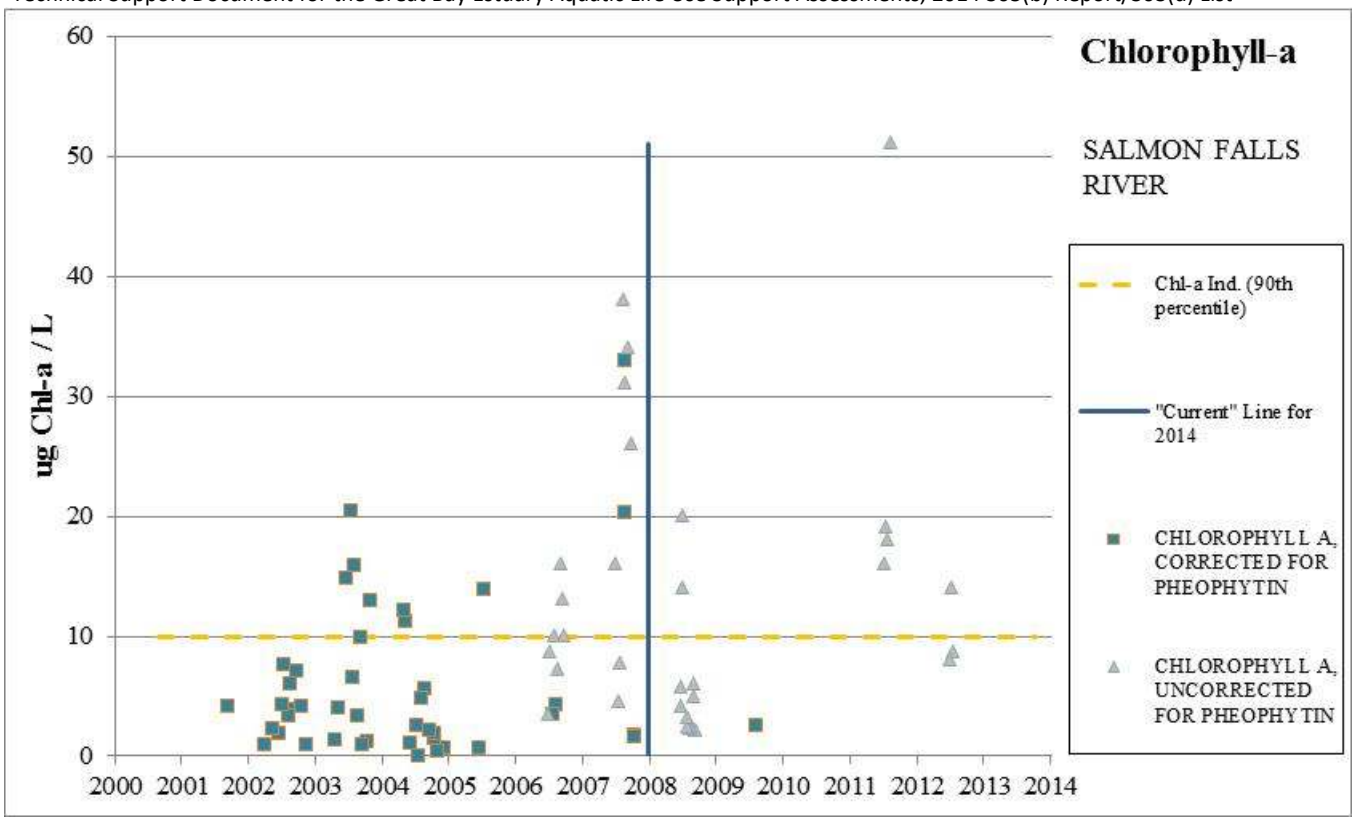

Total Nitrogen
COCHECO RIVER
Total Nitrogen (ug N/L)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
TN Gulf of Maine (median)
"Current" Line for 2014
Day Ave of TN

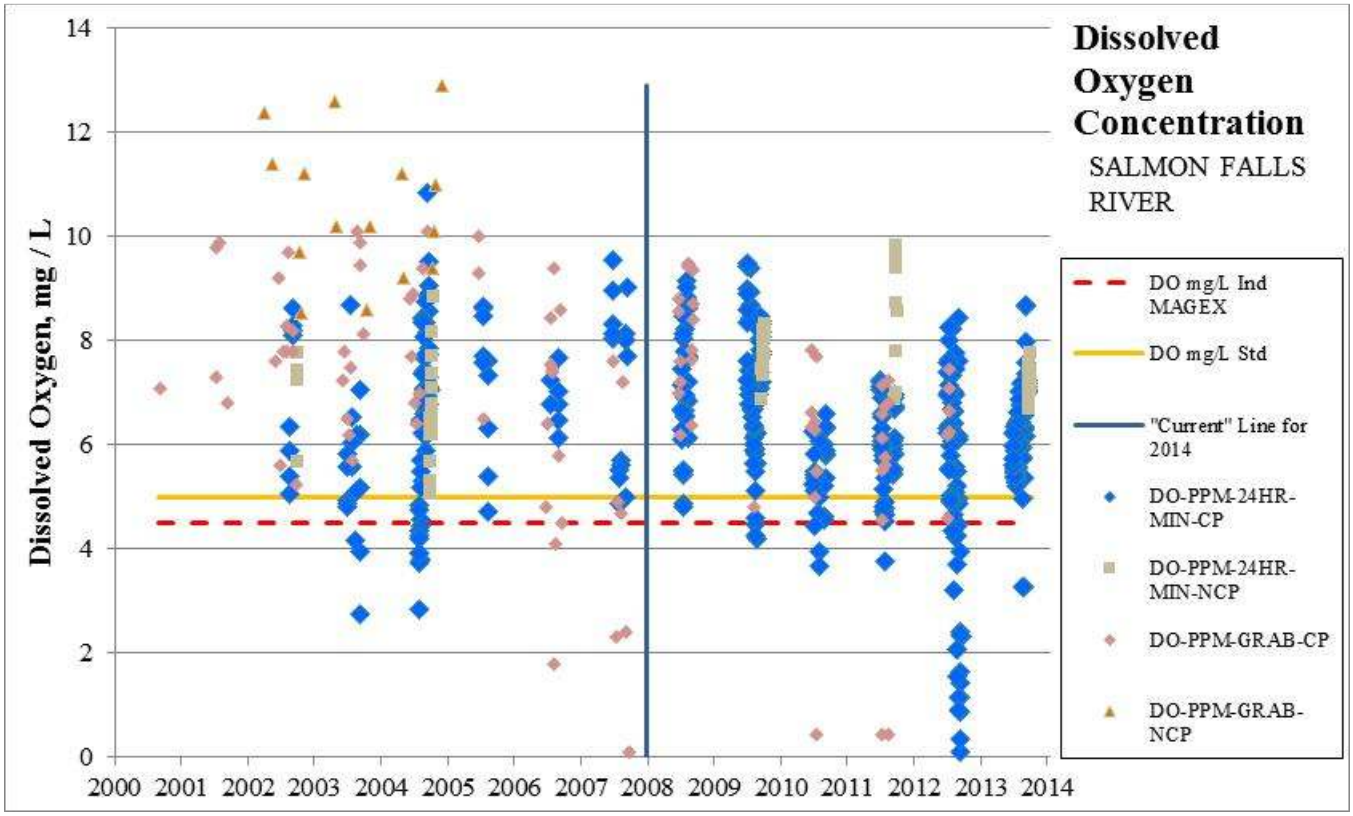
Cocheco River Assessment Zone (January 1, 2008 to November 7, 2014)	**Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	1	9.0	9.0	-	9.0
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	13	1.1	5.1	38.2	45.0
CHLOROPHYLL A, combined	14	1.1	5.1	36.5	45.0
DO-PERC-24H-MEAN-CP	88	74.7	94.9	116.7	130.8
DO-PERC-24H-MEAN-NCP	-	-	-	-	-
DO-PERC-2TIDE-GRAB-CP	6	84.4	89.8	-	103.7
DO-PERC-2TIDE-GRAB-NCP	7	85.7	89.6	-	97.6
DO-PPM-24HR-MIN-CP	102	4.4	6.7	7.5	8.1
DO-PPM-24HR-MIN-NCP	-	-	-	-	-
DO-PPM-GRAB-CP	17	5.9	7.9	8.5	8.6
DO-PPM-GRAB-NCP	12	8.1	9.1	11.0	11.2
LIGHT ATTENUATION COEFFICIENT	1	1.417	**1.417**	-	1.417
TURBIDITY	-	-	-	-	-
Day Ave of TN	9	360	**600**	1,600	1,600
Day Ave of TDN	1	357	357	-	357
Day Ave of DIN (NH3 + NO2/3)	7	50	209	-	889
Day Ave of NH3	8	23	66	-	500
Day Ave of PON	1	209	209	-	209
Day Ave of NO2/3	10	27	145	1,708	1,800

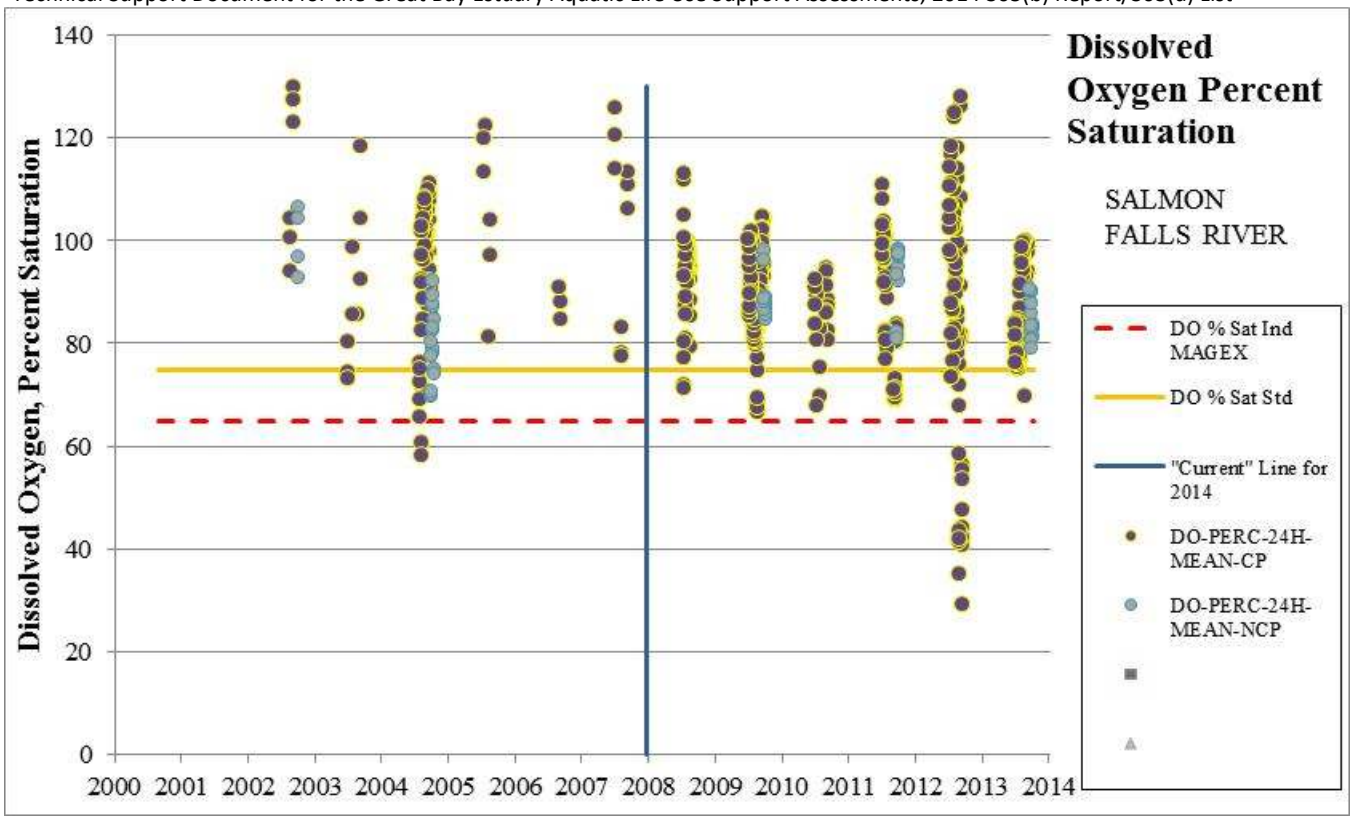
Assessment Zone = SALMON FALLS RIVER

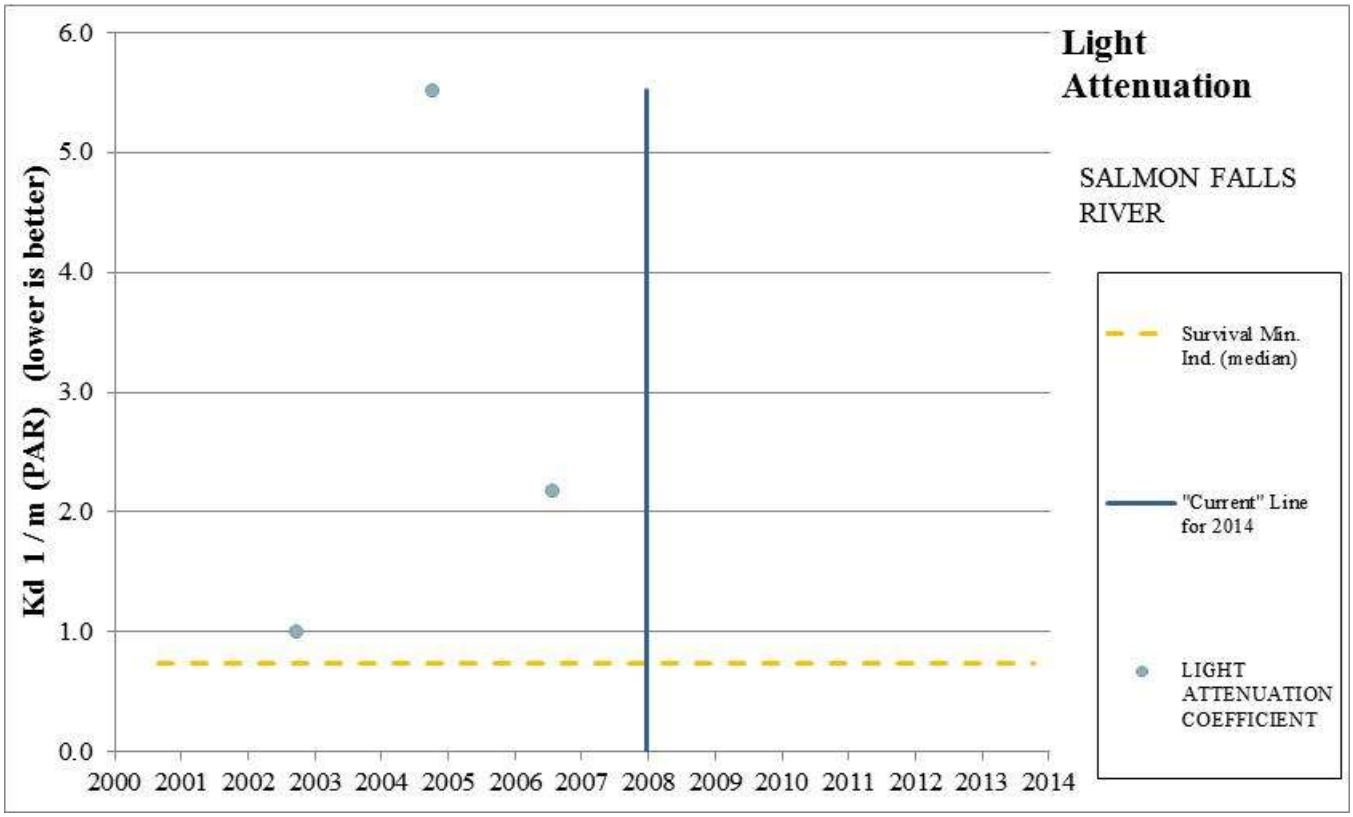
(NHEST600030406-01)

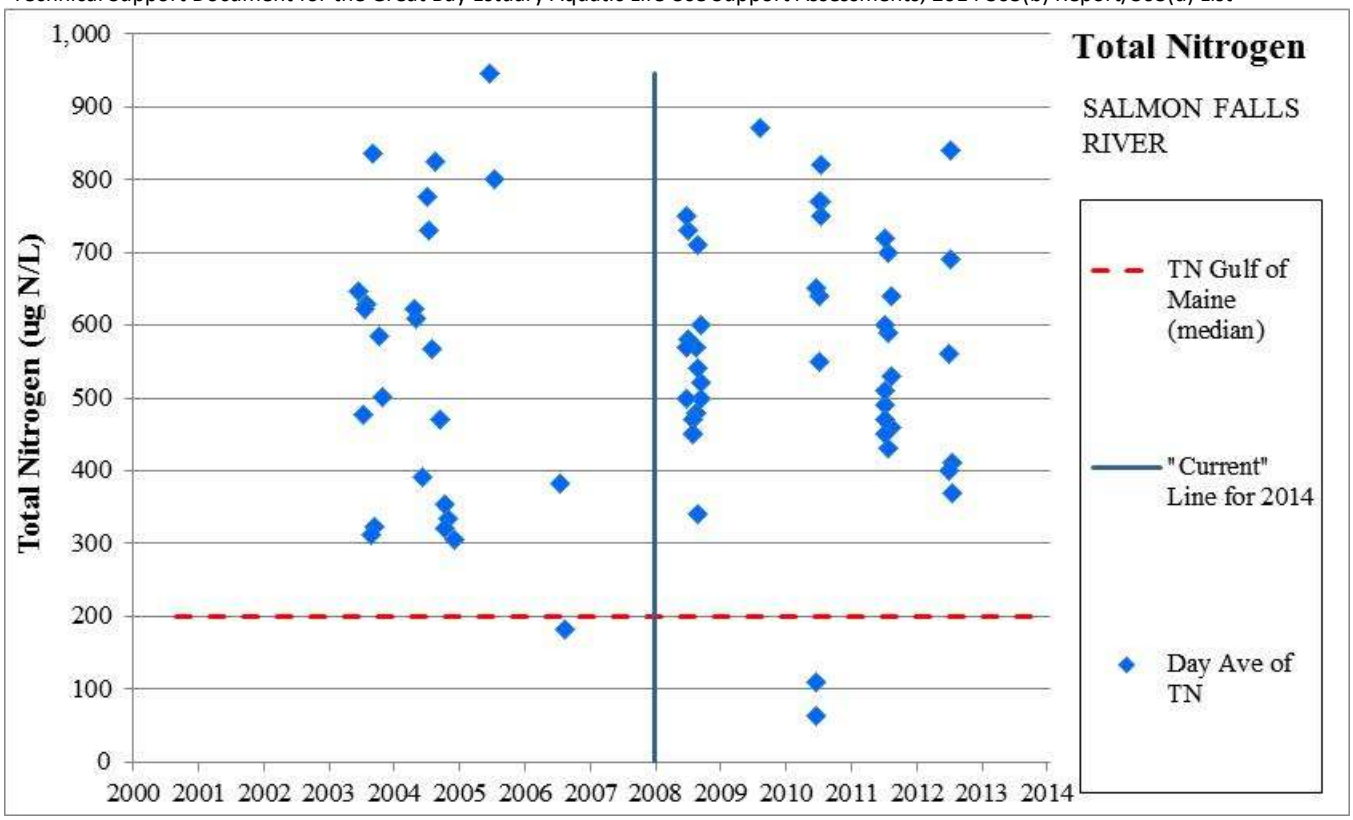
Indicator	Aquatic Life Use Category 2012 / 2014	2014
Chlorophyll-a	5-P /5-P	The calculated 90th percentile chlorophyll-a in this assessment zone is 20 ug/L (n = 20) and a maximum reading of 51 ug/L. The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L. Additionally, there are still frequent dissolved oxygen concentration and percent saturation criteria exceedences.
Dissolved Oxygen (mg/L)	5-P / 5-P	Dissolved oxygen concentration measurements in this assessment zone fall below the 5 mg/L criteria every year. In most years a portion of those measurements fall below 4 mg/L and in 2012 there were many measurements below 1 mg/L, as such, this impairment is considered severe.
Dissolved Oxygen (% Saturation)	5-M / 5-P	Dissolved oxygen 24 hour average percent saturation measurements in this assessment zone fall below the 75 percent criteria every year. In 2012 many of the datalogger based 24 hour averages were below 50 percent, as such, this impairment is considered severe.
Estuarine Bioassessments (eelgrass)	No Std / No Std	Not applicable. Eelgrass habitat has not historically existed in this assessment zone.
Water Clarity (Light Attenuation Coefficient)	No Std / No Std	Not applicable. The water clarity has not been assessed because eelgrass has not historically existed in this assessment zone.
Total Nitrogen	5-M / 5-M	The median total nitrogen from 2008 through 2013 was 550 ug/L (n=45). New Hampshire is no longer comparing ambient total nitrogen data to the total nitrogen numeric indicators used in the 2012 assessment as translators for the narrative water quality criteria. This assessment zone experiences frequent dissolved oxygen concentrations well below 5 mg/L and daily average saturation below 75 percent. During multiple years this assessment zone also demonstrated super saturation over 125% including peak saturations of 138% (2013), 162% (2012), 134% (2011), 125% (2010), and 153% (2008). The chlorophyll-a concentration 90th percentile was 20 ug/L (n = 20) and a maximum reading of 51 ug/L. Many of the classic indicators of nutrient eutrophication are present in this assessment zone. As such, the impairment for nitrogen has been retained.


Chlorophyll-a
SALMON FALLS RIVER
ug Chl-a / L
60
50
40
30
20
10
0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Chl-a Ind. (90th percentile)
"Current" Line for 2014
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN


Dissolved Oxygen Concentration
SALMON FALLS RIVER
Dissolved Oxygen, mg / L
14
12
10
8
6
4
2
0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2014
DO-PPM-24HR-MIN-CP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP
DO-PPM-GRAB-NCP


Dissolved Oxygen Percent Saturation
SALMON FALLS RIVER
Dissolved Oxygen, Percent Saturation
140
120
100
80
60
40
20
0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2014
DO-PERC-24H-MEAN-CP
DO-PERC-24H-MEAN-NCP


Light Attenuation
SALMON FALLS RIVER
Kd 1 / m (PAR) (lower is better)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Survival Min. Ind. (median)
"Current" Line for 2014
LIGHT ATTENUATION COEFFICIENT



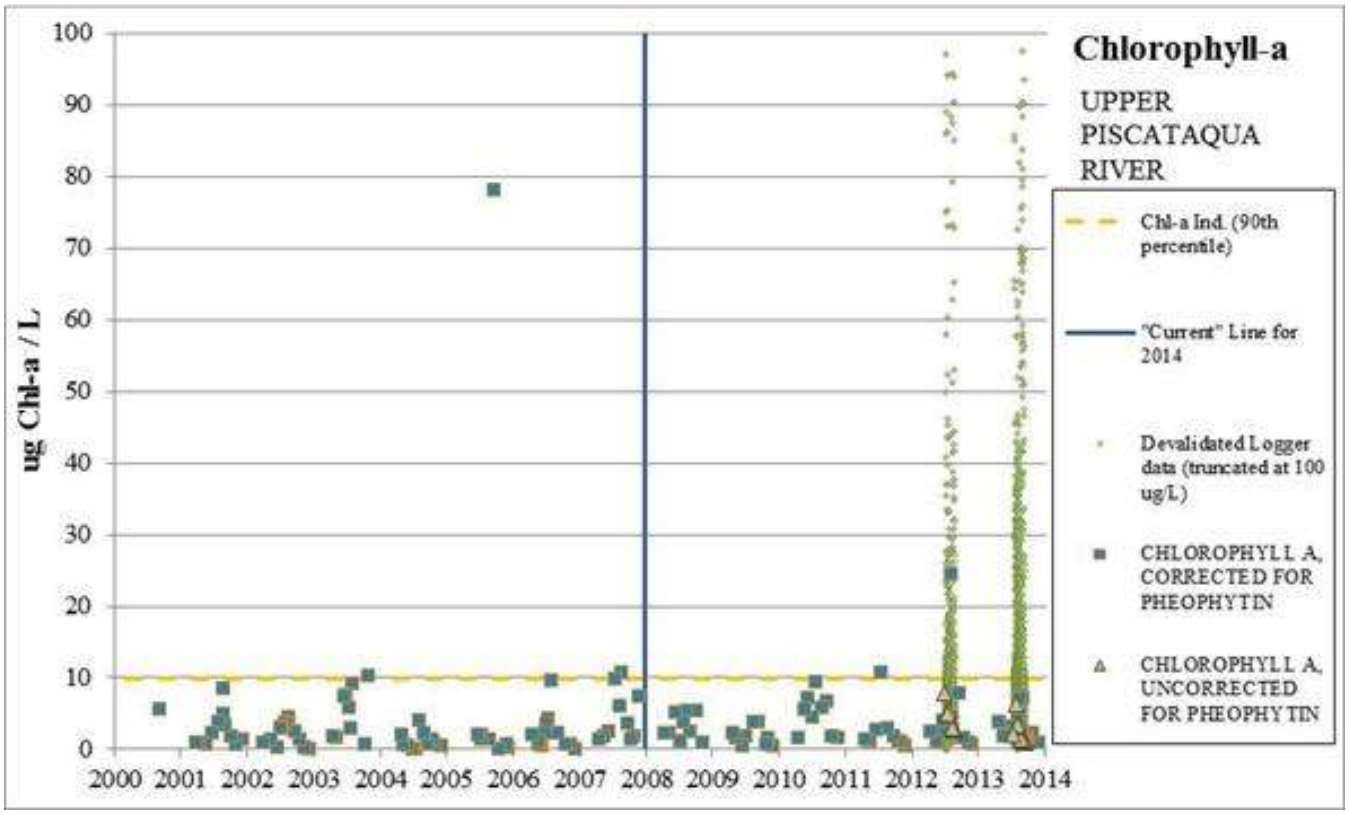
Salmon Falls River Assessment Zone (January 1, 2008 to November 7, 2014)	**Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	1	2.6	2.6	-	2.6
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	19	2.1	5.9	20.0	51.0
CHLOROPHYLL A, combined	20	2.1	5.8	19.9	51.0
DO-PERC-24H-MEAN-CP	327	29.4	88.2	102.9	128.2
DO-PERC-24H-MEAN-NCP	37	79.3	87.2	97.6	98.5
DO-PERC-2TIDE-GRAB-CP	-	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP	-	-	-	-	-
DO-PPM-24HR-MIN-CP	345	0.1	6.3	8.3	9.5
DO-PPM-24HR-MIN-NCP	40	6.7	7.5	9.5	9.8
DO-PPM-GRAB-CP	43	0.4	6.7	9.1	9.5
DO-PPM-GRAB-NCP	-	-	-	-	-
LIGHT ATTENUATION COEFFICIENT	-	-	-	-	-
TURBIDITY	426	0.0	9.1	75.4	977.2
Day Ave of TN	45	63	**550**	770	871
Day Ave of TDN	1	641	641	-	641
Day Ave of DIN (NH3 + NO2/3)	44	50	145	245	340
Day Ave of NH3	46	10	40	100	160
Day Ave of PON	-	-	-	-	-
Day Ave of NO2/3	44	13	100	179	240

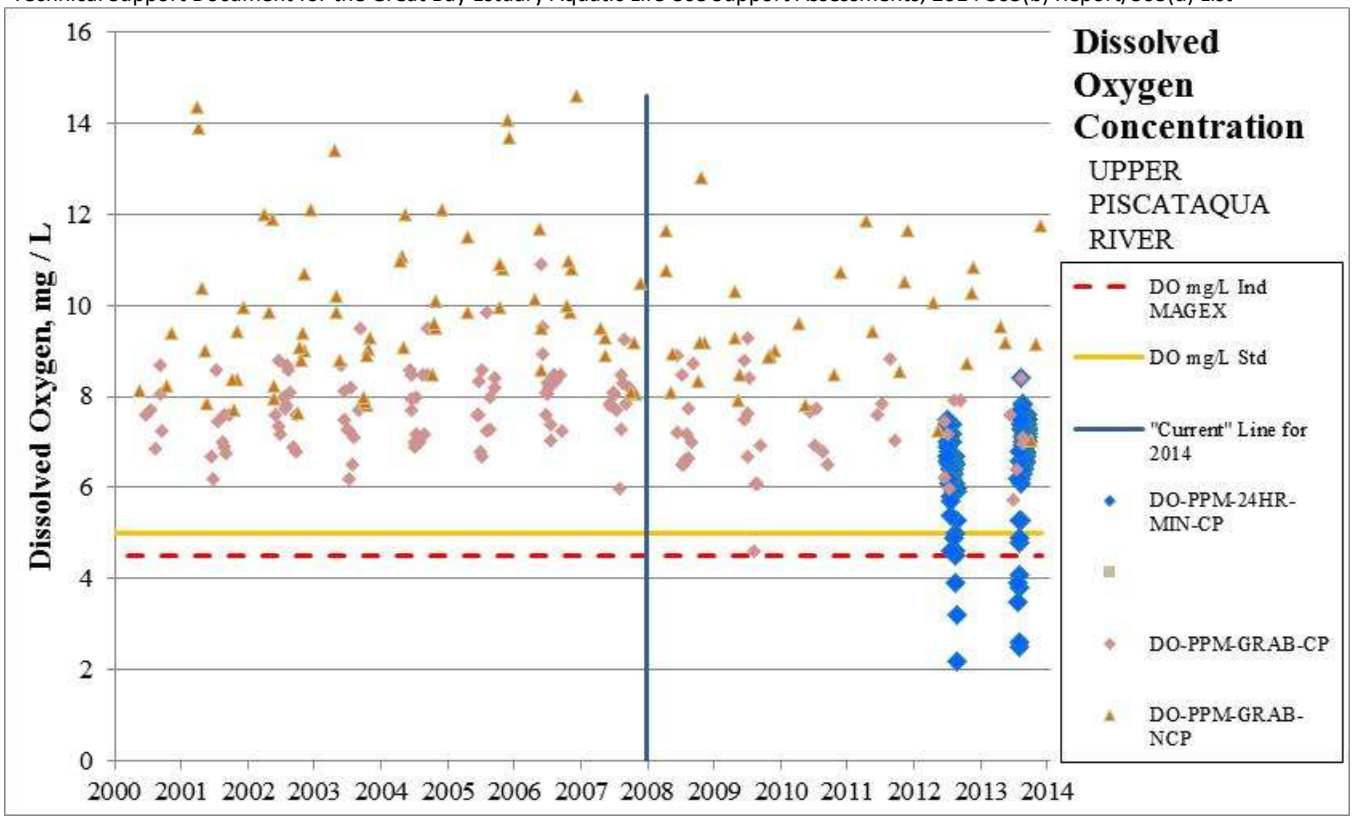
Assessment Zone = UPPER PISCATAQUA RIVER

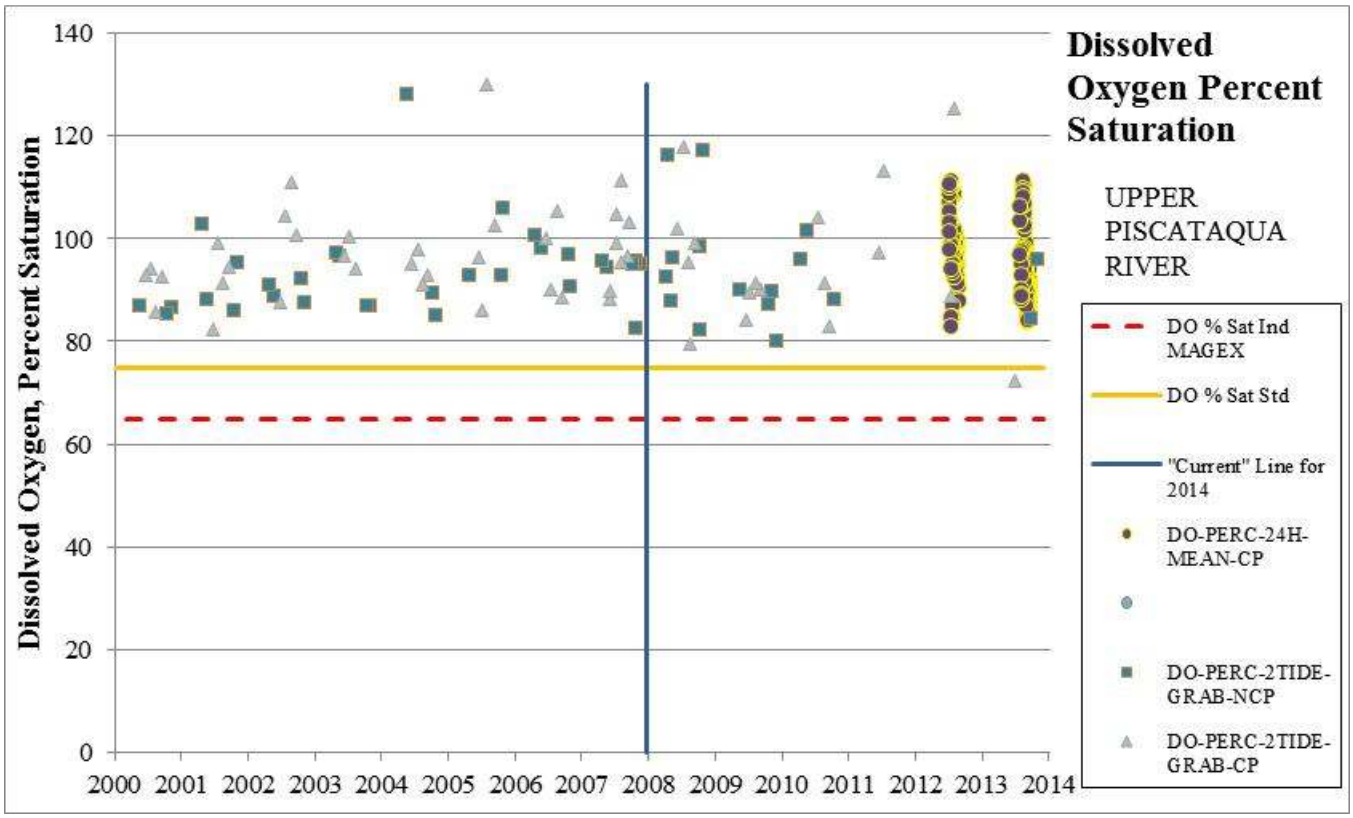
(NHEST600031001-01-01, NHEST600031001-01-02, NHEST600031001-01-03)

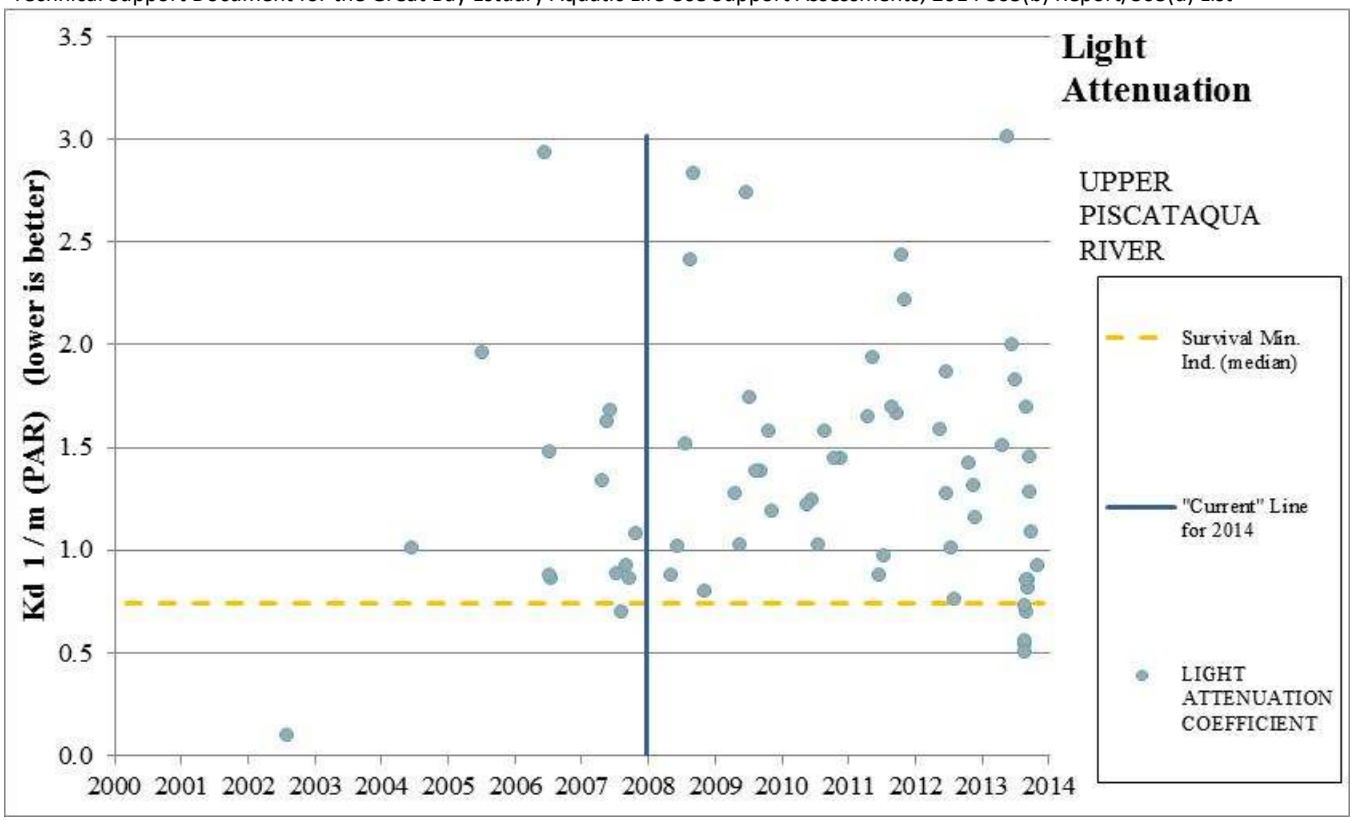
Indicator	Aquatic Life Use Category 2012 / 2014	2014
Chlorophyll-a	2-M / 2-M	The calculated 90th percentile chlorophyll-a in this assessment zone is 7.2 ug/L (n = 73) and a maximum reading of 24.5 ug/L. Although the probe based chlorophyll-a data (not used in the median above) collected from the UPR stations was qualified as "estimated" per EPA, due to poor correlation between probe and extracted chlorophyll-a grab sample data, the relative biomass is valid and shows severe spikes in chlorophyll-a. The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L.
Dissolved Oxygen (mg/L)	2-M / 3-PNS	Before 2012, only grab samples of dissolved oxygen had been collected in the Upper Piscataqua River assessment zone. In 2012, four locations along this assessment zone had two week datalogger deployments in a series. In 2012 site UPR4 had one minor excursion below 5 mg/L during high tide when that high tide coincided with the early morning hours while freshwater inflow was low at 0.18 cfsm and water temperatures ranged from 19 - 23° C. In 2013 at site UPR4 there were several excursions below 5 mg/L (as low as 2.5 mg/L) that all occurred on a rising tide at an assortment of times of day while freshwater inflow was 0.34 – 0.47 cfsm, and water temperature ranged from 19 – 22° C. UPR4 lies 0.25 mile upstream from the Dover WWTF outfall. In 2012, site UPR8 had several short duration excursions below 5 mg/L (as low as 2.0 mg/L) that all occurred at low tide and the lowest reading were during late night or early morning hours while freshwater inflow was 0.08 – 0.40 cfsm and water temperature ranged from 19 – 23° C. UPR8 did not show exceedences in 2013, however, the water temperature was lower (14 – 21° C) in 2013 and freshwater inflow was higher (0.18 – 3.30 cfsm). UPR8 lies 1.5 miles downstream from the Dover WWTF outfall. The frequency, duration, and magnitude of those dips have not risen to the severity that warrants and impairment. Acknowledging the existing data, this assessment zone is being assessed as potentially not supporting the dissolved oxygen indicator.
Dissolved Oxygen (% Saturation)	2-G / 2-G	This assessment zone has only grab sample measurements for dissolved oxygen 24 hour average percent saturation in 2008 through 2011. In 2012 and 2013 dataloggers were deployed and no 24 hour averages fell below 75 percent. The available data indicates that this assessment zone meets the dissolved oxygen saturation criteria.
Estuarine Bioassessments (eelgrass)	5-P / 5-P	The historical extent of eelgrass in this assessment zone was 79.7 acres from the 1948, 1962, 1980, and 1981 datasets. The median current extent of eelgrass in 2011-2013 is 0 acres, which is a decrease of 100%. Since 1990, the trend in eelgrass cover in this assessment zone is a loss of 57.9%. The thresholds for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	5-P / 5-P	Median=1.330 m^-1 (n=53). For an eelgrass restoration depth of 2 m, the light attenuation coefficient threshold is 0.75 m^-1. This assessment zone historically had eelgrass growing in both the shallows and some in deeper habitat making the 2m restoration depth a valid target. Therefore, the impaired (5-P) listing from the 2012 303d list has been retained.
Total Nitrogen	5-P / 3-PNS	The median total nitrogen from 2008 through 2013 was 454 ug/L (n=53). New Hampshire is no longer comparing ambient total nitrogen data to the total nitrogen numeric indicators used in the 2012 assessment as translators for the narrative water quality criteria. While the Dissolved oxygen data shows that this assessment zone experiences short duration concentrations below the 5 mg/L criteria, they do not support an impairment determination for DO. The 24 hour average dissolved oxygen percent saturation did not fall below 75% in the available dataset. The calculated 90th percentile chlorophyll-a in this assessment zone is 7.2 ug/L (n = 73) and a maximum reading of 24.5 ug/L. Although the probe-based chlorophyll-a data (not used in the median above) collected from the UPR stations was qualified as "estimated" per EPA, due to poor correlation between probe and extracted chlorophyll-a grab sample data, the relative biomass is valid and shows large spikes in chlorophyll-a under certain conditions. The grab sample-based light attenuation (median=1.330 m^-1 (n=53)) is quite poor suggesting strong

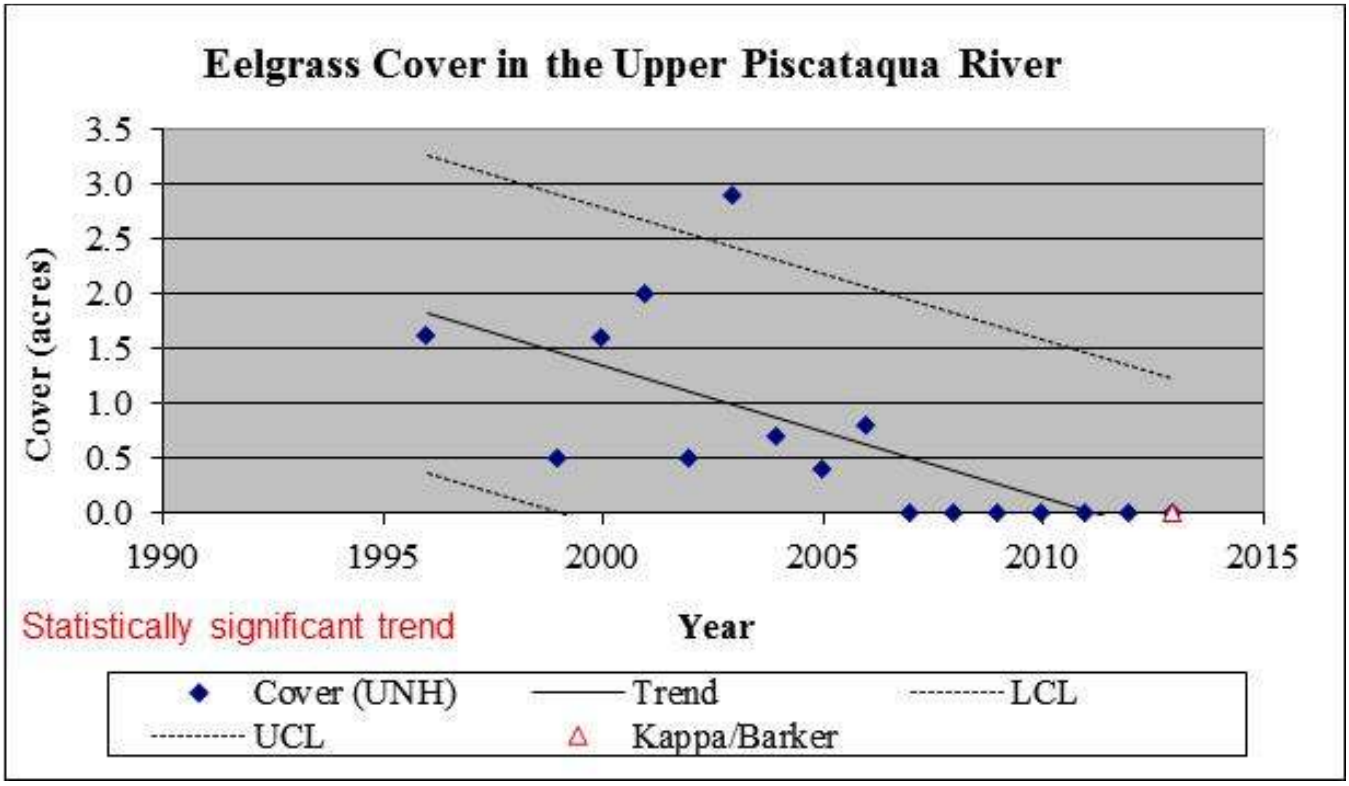
		resuspension in the system. For shallow systems, it is expected that changes in macroalgae will precede changes in phytoplankton (McGlathery, Sundbäck, & Anderson, 2007) (Valiela, et al., 1997), as appears to be occurring in the Great Bay Estuary. The foremost authority on macroalgae for this estuary, Dr. Arthur C. Mathieson, commented on the draft 2012 303(d) that he remains concerned about the macroalgae and epiphyte conditions in Great Bay (NHDES, 2013). At this time there are some of the classic indicators of nutrient eutrophication present in this assessment zone and Total Nitrogen remains high. However, there are insufficient response datasets to determine that the eutrophication by total nitrogen alone is not known to be strong enough to warrant impairment under New Hampshire's narrative standard. As such, this assessment zone has been assessed as Insufficient Information – Potentially Not Supporting (3-PNS) for total nitrogen.

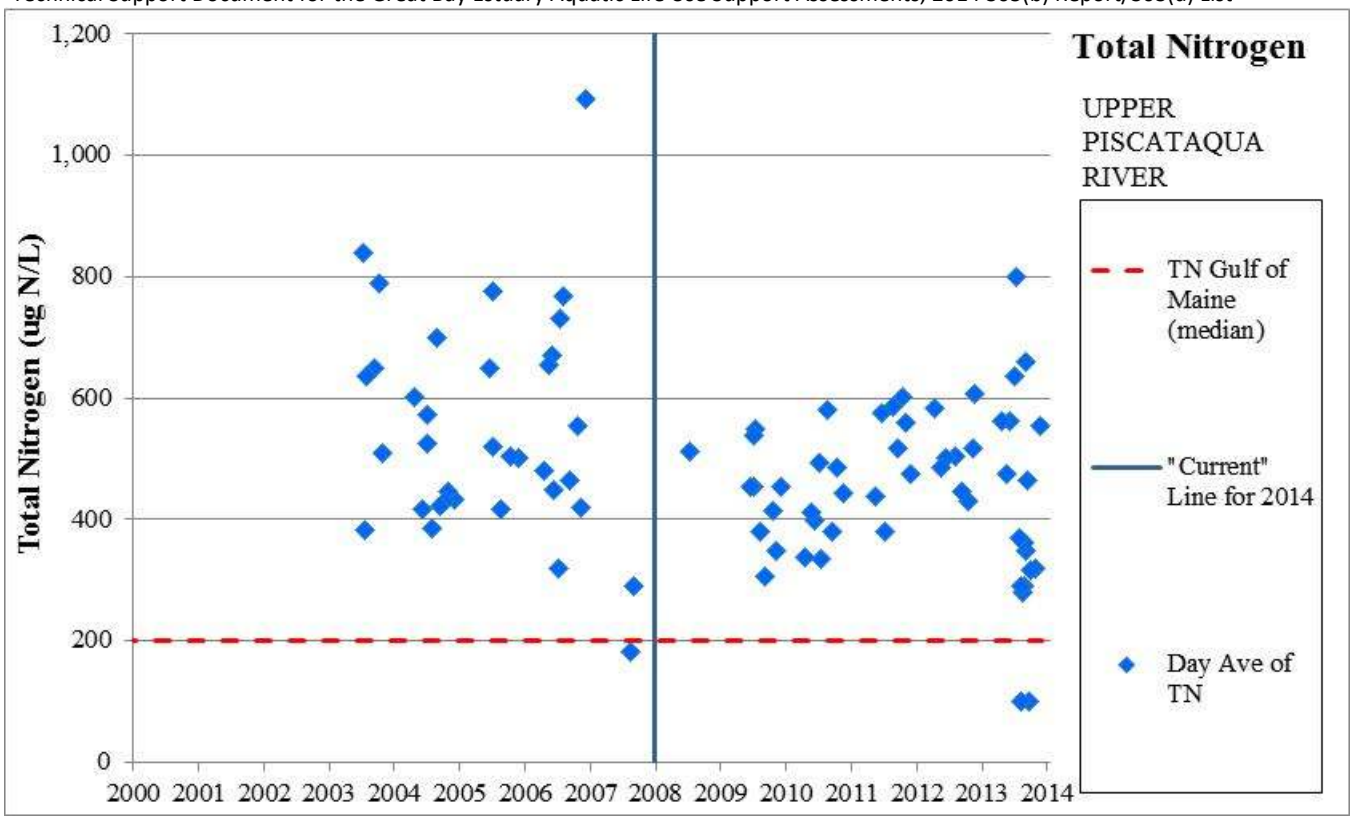



Dissolved Oxygen Concentration
UPPER PISCATAQUA RIVER
Dissolved Oxygen, mg / L
0
2
4
6
8
10
12
14
16
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2014
DO-PPM-24HR-MIN-CP
DO-PPM-GRAB-CP
DO-PPM-GRAB-NCP


Dissolved Oxygen Percent Saturation
UPPER PISCATAQUA RIVER
Dissolved Oxygen, Percent Saturation
0
20
40
60
80
100
120
140
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2014
DO-PERC-24H-MEAN-CP
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP


Light Attenuation
UPPER PISCATAQUA RIVER
Kd 1 / m (PAR) (lower is better)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Survival Min. Ind. (median)
"Current" Line for 2014
LIGHT ATTENUATION COEFFICIENT


Eelgrass Cover in the Upper Piscataqua River
Cover (acres)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1990 1995 2000 2005 2010 2015
Statistically significant trend
Year
Cover (UNH)
Trend
LCL
UCL
Kappa/Barker

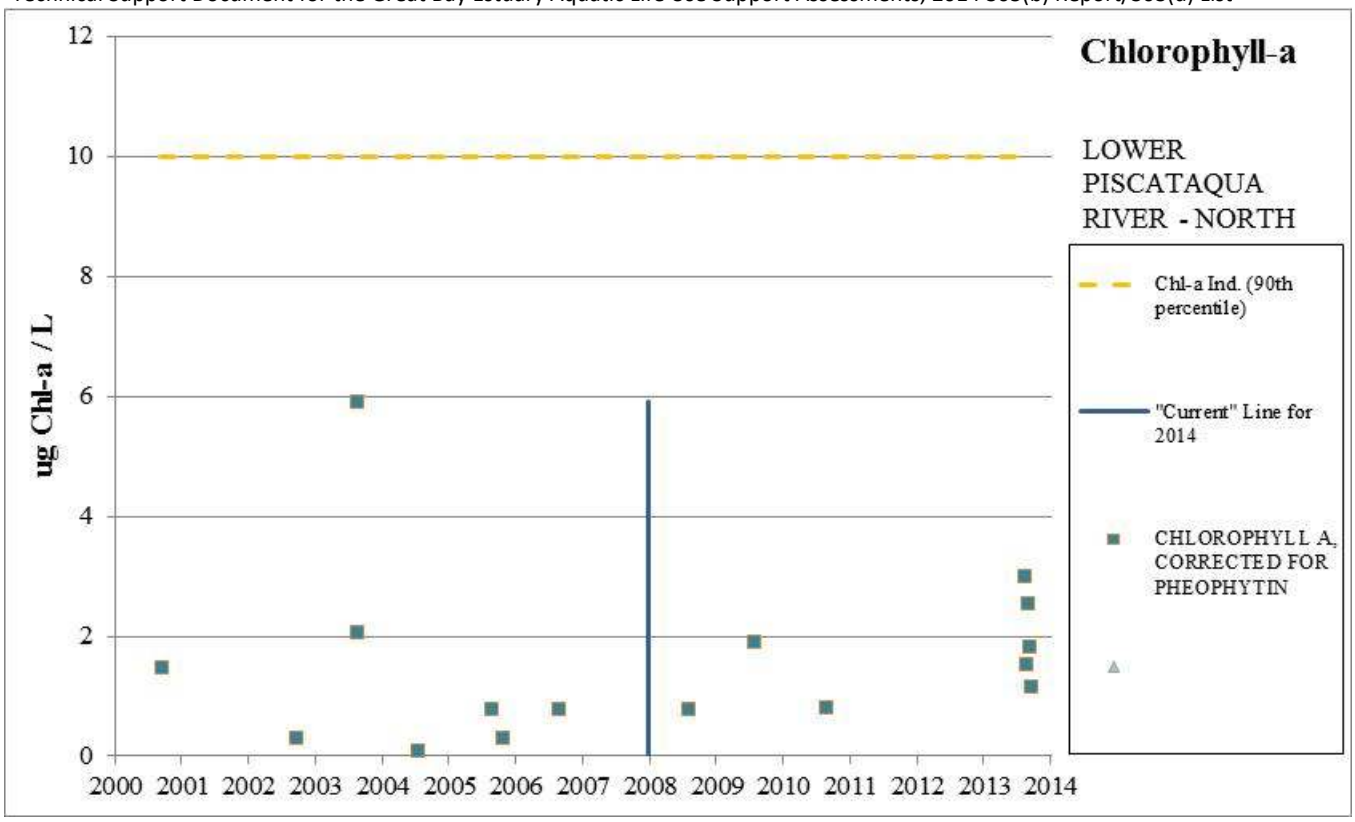

Total Nitrogen
UPPER PISCATAQUA RIVER
Total Nitrogen (ug N/L)
1,200
1,000
800
600
400
200
0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
TN Gulf of Maine (median)
"Current" Line for 2014
Day Ave of TN

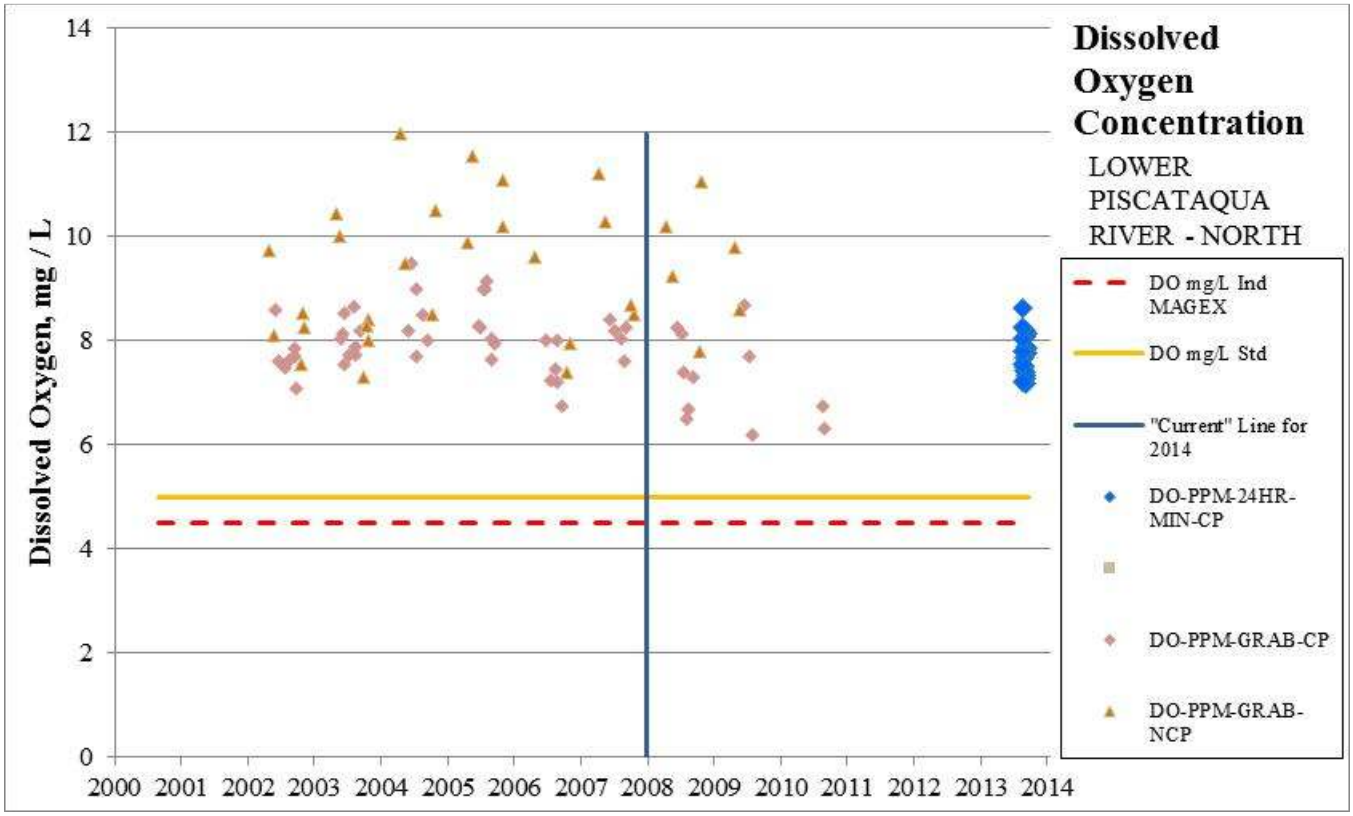
Upper Piscataqua River Assessment Zone (January 1, 2008 to November 7, 2014)	**Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	62	0.4	2.4	**7.2**	24.5
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	11	1.1	3.1	7.7	8.0
CHLOROPHYLL A, combined	73	0.4	2.4	7.2	24.5
DO-PERC-24H-MEAN-CP	129	83.0	95.6	108.8	111.3
DO-PERC-24H-MEAN-NCP	-	-	-	-	-
DO-PERC-2TIDE-GRAB-CP	17	72.5	91.4	119.3	125.5
DO-PERC-2TIDE-GRAB-NCP	16	80.3	91.3	116.7	117.4
DO-PPM-24HR-MIN-CP	144	2.2	6.7	7.4	8.4
DO-PPM-24HR-MIN-NCP	-	-	-	-	-
DO-PPM-GRAB-CP	43	4.6	7.2	8.8	9.3
DO-PPM-GRAB-NCP	34	7.0	9.2	11.7	12.8
LIGHT ATTENUATION COEFFICIENT	53	0.520	**1.330**	2.350	3.030
TURBIDITY	29	8.4	35.8	82.7	99.3
Day Ave of TN	53	100	**454**	596	800
Day Ave of TDN	59	141	372	506	843
Day Ave of DIN (NH3 + NO2/3)	64	5	218	376	465
Day Ave of NH3	67	3	53	115	500
Day Ave of PON	3	84	134	-	139
Day Ave of NO2/3	64	2	156	247	386

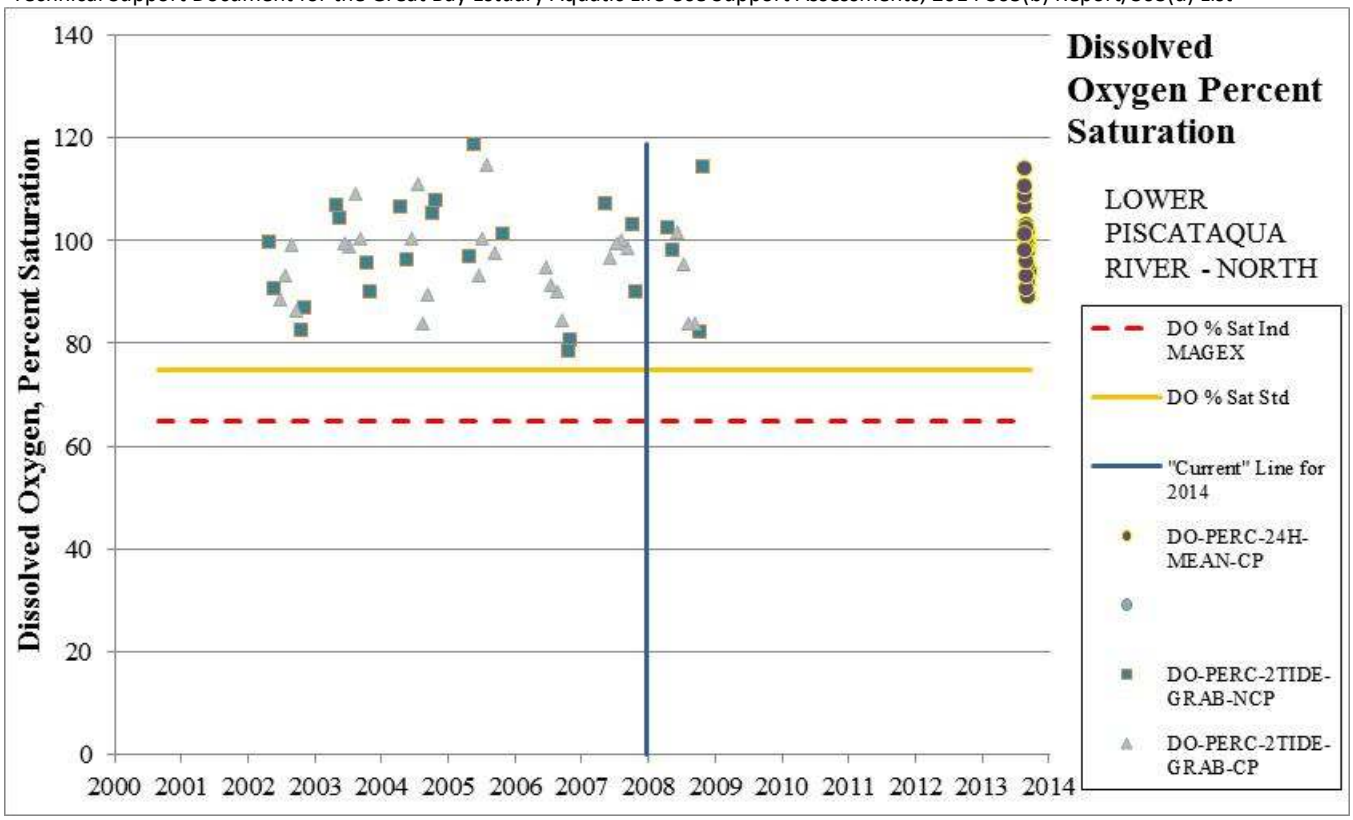
Assessment Zone = LOWER PISCATAQUA RIVER - NORTH

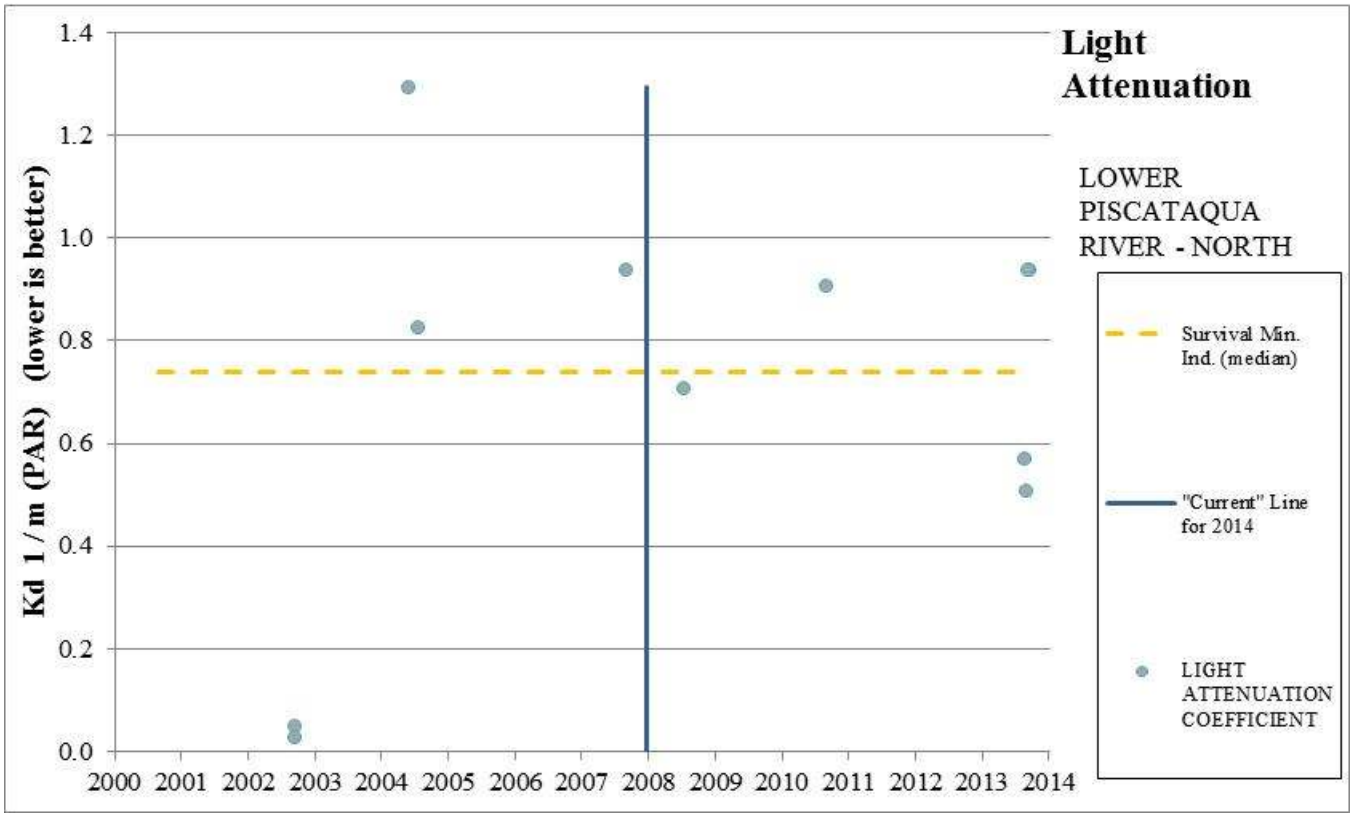
(NHEST600031001-02-01)

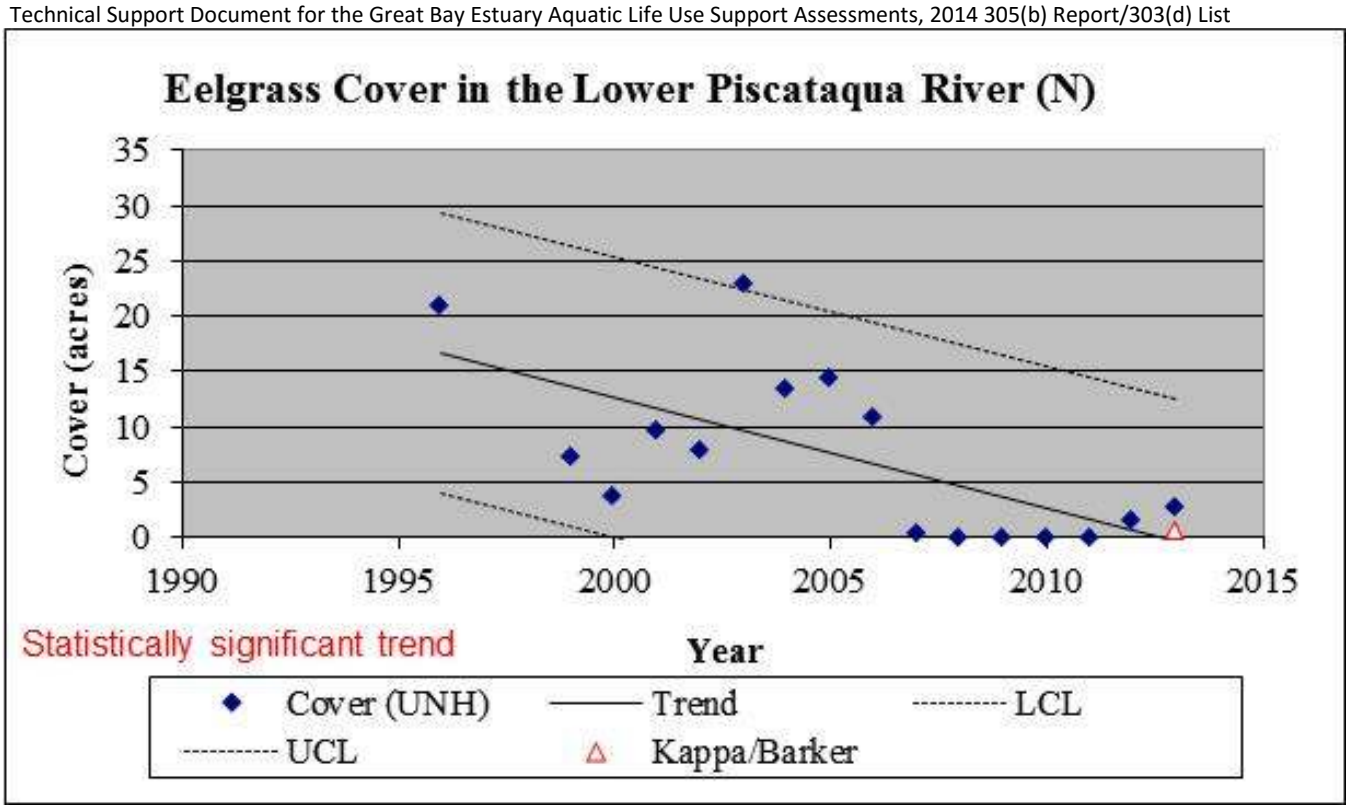
Indicator	Aquatic Life Use Category 2012 / 2014	2014
Chlorophyll-a	3-PAS / 3-PAS	The calculated 90th percentile chlorophyll-a in this assessment zone cannot be calculated due to the presence of only eight measured values in since 2008 (0.8 to 3.0 ug/L). The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L. The limited available data leads to an assessment of Insufficient Information – Potentially Attaining Standards.
Dissolved Oxygen (mg/L)	2-G / 2-G	This assessment zone has only grab sample measurements for dissolved oxygen concentration in 2008 through 2010 and a datalogger deployment in 2013. During those periods no dissolved oxygen concentration measurements fell below 5 mg/L. The available data indicates that this assessment zone meets the dissolved oxygen concentration criteria.
Dissolved Oxygen (% Saturation)	2-G / 2-G	This assessment zone has only grab sample measurements to evaluate the dissolved oxygen 24 hour average percent saturation criteria in 2008 and a datalogger deployment in 2013. During those periods no 24 hour averages fell below 75 percent. The available data indicates that this assessment zone meets the dissolved oxygen saturation criteria.
Estuarine Bioassessments (eelgrass)	5-P / 5-P	The historical extent of eelgrass in this assessment zone was 60.1 acres from the 1948, 1962, 1980, and 1981 datasets. The median current extent of eelgrass in 2011-2013 is 1.6 acres, which is a decrease of 97.3%. Since 1990, the trend in eelgrass cover in this assessment zone is a loss of 45.9%. The thresholds for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	3-PNS / 3-PNS	Median=0.818 m^-1 (n=6). For an eelgrass restoration depth of 2 m, the light attenuation coefficient threshold is 0.75 m^-1. This assessment zone historically had eelgrass growing in both the shallows and deeper habitat making the 2m restoration depth a valid target. Therefore, the insufficient information – potentially not supporting (3-PNS) assessment from the 2012 305(b) list has been retained.
Total Nitrogen	3-PNS / 3-PNS	The median total nitrogen from 2008 through 2013 was 390 ug/L (n=7). New Hampshire is no longer comparing ambient total nitrogen data to the total nitrogen numeric indicators used in the 2012 assessment as translators for the narrative water quality criteria. There are no documented dissolved oxygen concentration or saturation criteria exceedences in the available data. The limited chlorophyll-a data suggests that this assessment zone would meet chlorophyll-a indicator to protect dissolved oxygen. The eelgrass beds are severely degraded and the available light attenuation (median=0.818 m^-1 (n=6)) is poor. While total nitrogen is elevated there are insufficient data to indicate that the eutrophication is strong enough to warrant impairment. As such, the insufficient information-potential not supporting assessment for nitrogen has been retained.

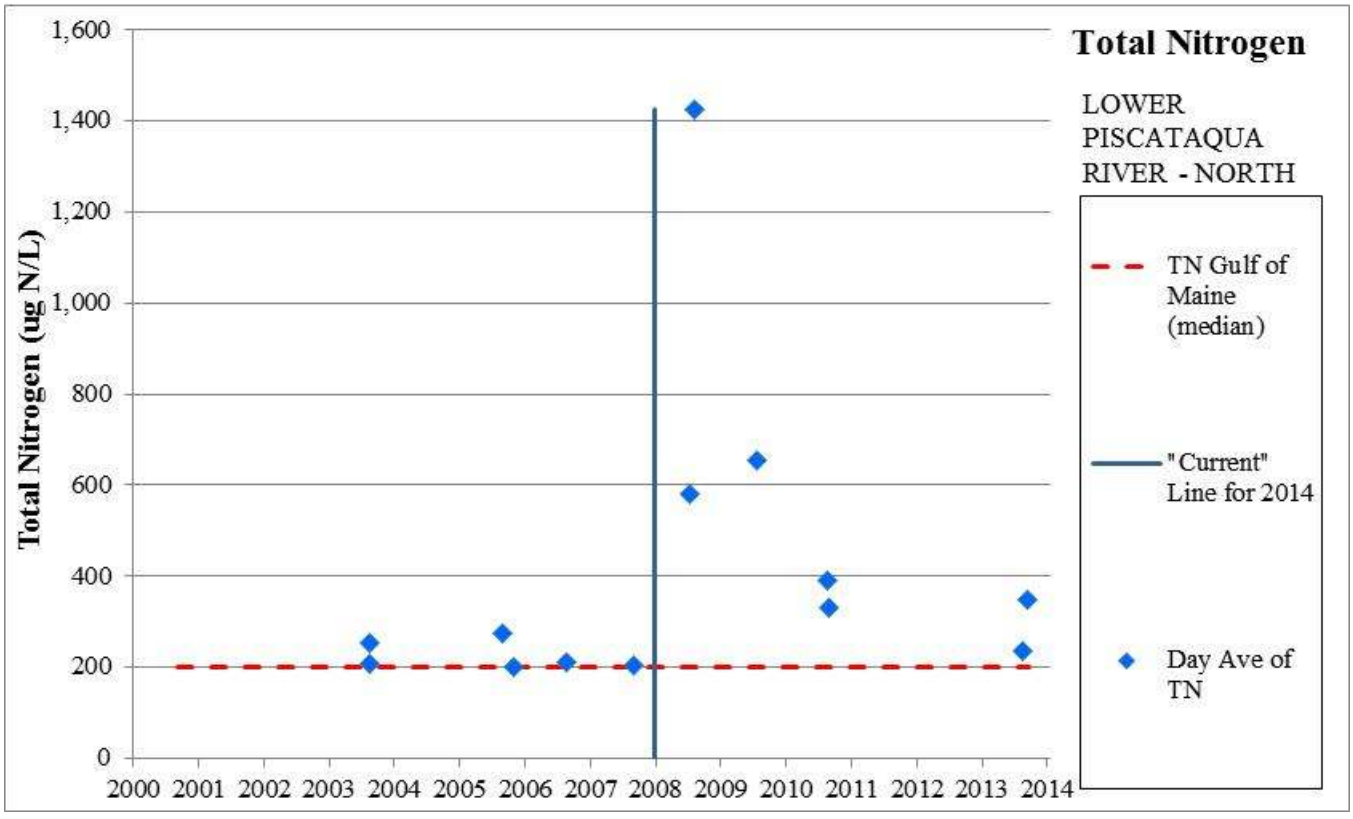

Chlorophyll-a
LOWER PISCATAQUA RIVER - NORTH
ug Chl-a / L
Chl-a Ind. (90th percentile)
"Current" Line for 2014
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN
0
2
4
6
8
10
12
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014


Dissolved Oxygen Concentration
LOWER PISCATAQUA RIVER - NORTH
Dissolved Oxygen, mg / L
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2014
DO-PPM-24HR-MIN-CP
DO-PPM-GRAB-CP
DO-PPM-GRAB-NCP
0
2
4
6
8
10
12
14
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014


Dissolved Oxygen Percent Saturation
LOWER PISCATAQUA RIVER - NORTH
Dissolved Oxygen, Percent Saturation
140
120
100
80
60
40
20
0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2014
DO-PERC-24H-MEAN-CP
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP


Light Attenuation
LOWER PISCATAQUA RIVER - NORTH
Kd 1 / m (PAR) (lower is better)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Survival Min. Ind. (median)
"Current" Line for 2014
LIGHT ATTENUATION COEFFICIENT


Eelgrass Cover in the Lower Piscataqua River (N)
Cover (acres)
35
30
25
20
15
10
5
0
1990
1995
2000
2005
2010
2015
Statistically significant trend
Year
Cover (UNH)
Trend
LCL
UCL
Kappa/Barker

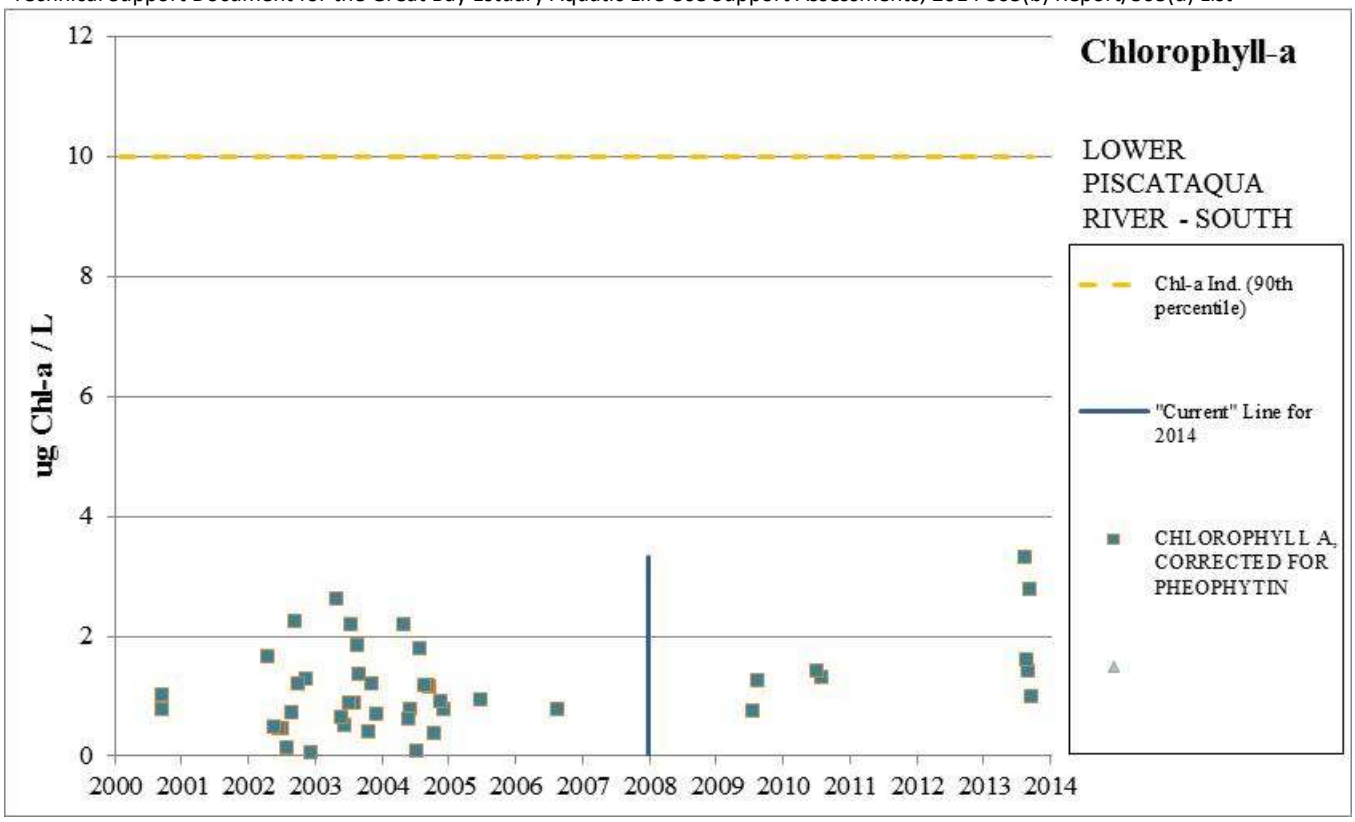

Total Nitrogen
LOWER PISCATAQUA RIVER - NORTH
Total Nitrogen (ug N/L)
1,600
1,400
1,200
1,000
800
600
400
200
0
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
TN Gulf of Maine (median)
"Current" Line for 2014
Day Ave of TN

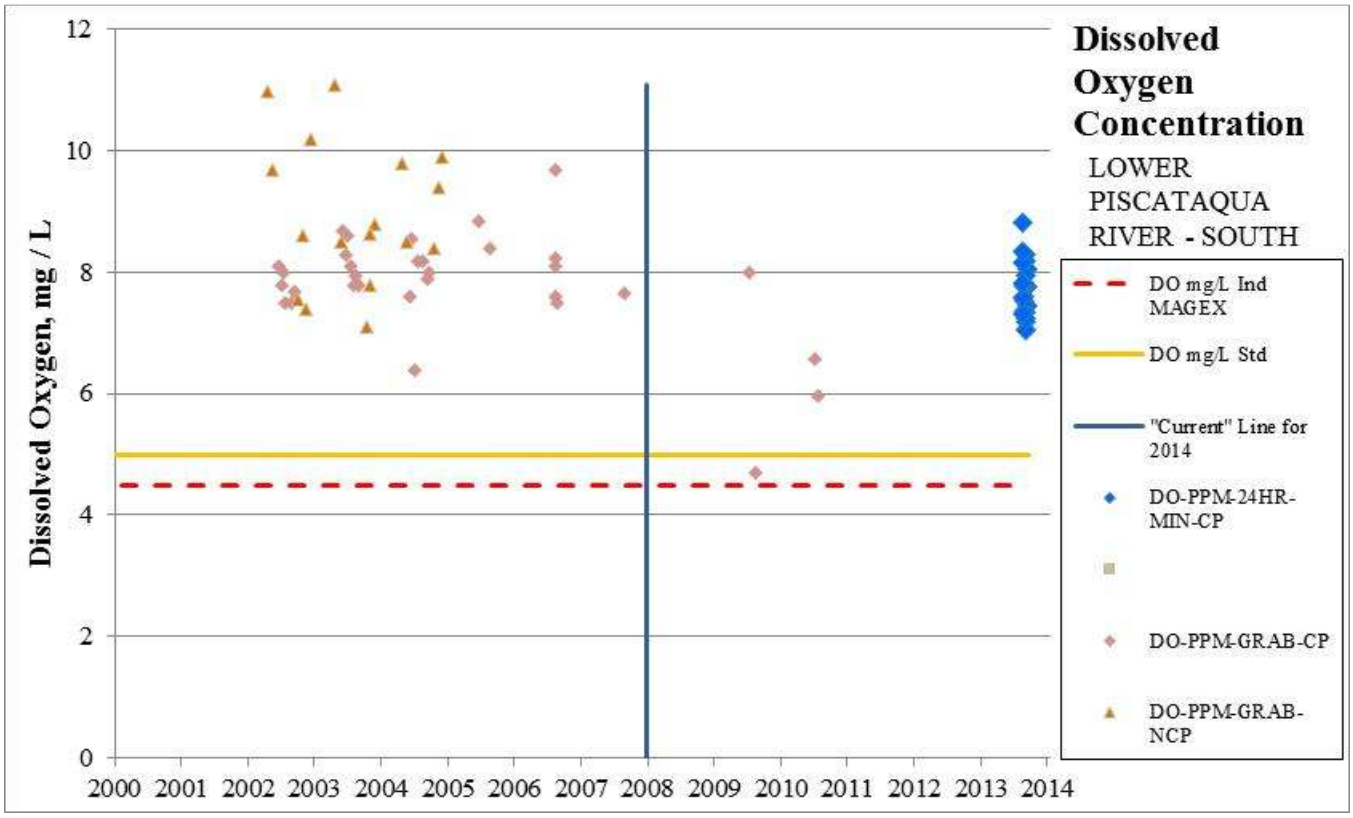
Lower Piscataqua River - North Assessment Zone (January 1, 2008 to November 7, 2014)	**Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	8	0.8	1.7	-	3.0
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	-	-	-	-	-
CHLOROPHYLL A, combined	8	0.8	1.7	-	3.0
DO-PERC-24H-MEAN-CP	26	89.2	98.3	109.5	114.1
DO-PERC-24H-MEAN-NCP	-	-	-	-	-
DO-PERC-2TIDE-GRAB-CP	4	83.9	89.7	-	101.6
DO-PERC-2TIDE-GRAB-NCP	4	82.3	100.5	-	114.6
DO-PPM-24HR-MIN-CP	24	7.2	7.8	8.2	8.6
DO-PPM-24HR-MIN-NCP	-	-	-	-	-
DO-PPM-GRAB-CP	11	6.2	7.3	8.6	8.7
DO-PPM-GRAB-NCP	6	7.8	9.5	-	11.1
LIGHT ATTENUATION COEFFICIENT	6	0.520	**0.818**	-	0.950
TURBIDITY	29	6.8	12.0	28.2	45.4
Day Ave of TN	7	236	**390**	-	1,426
Day Ave of TDN	7	164	309	-	1,345
Day Ave of DIN (NH3 + NO2/3)	7	8	153	-	211
Day Ave of NH3	7	3	40	-	160
Day Ave of PON	4	23	77	-	113
Day Ave of NO2/3	7	5	65	-	119

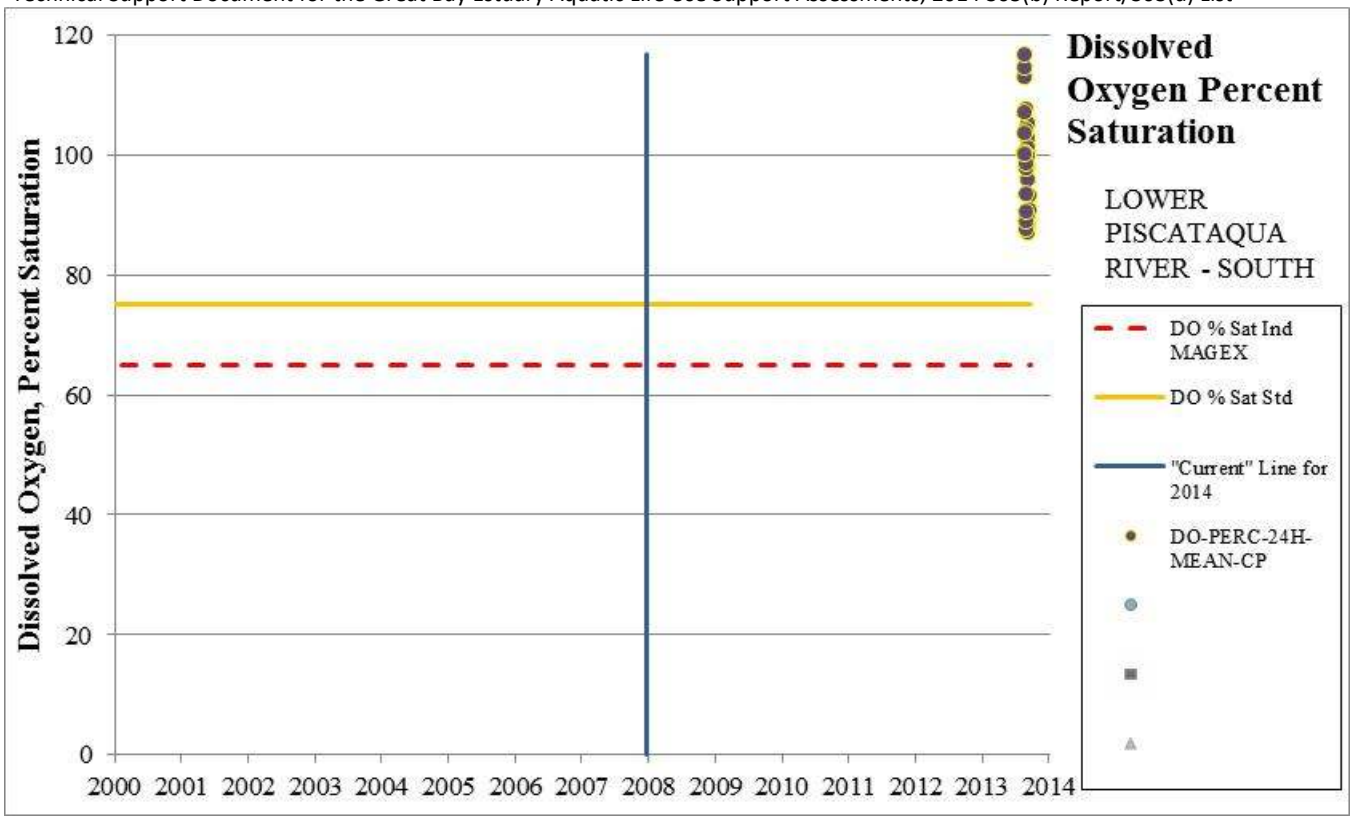
Assessment Zone = LOWER PISCATAQUA RIVER - SOUTH

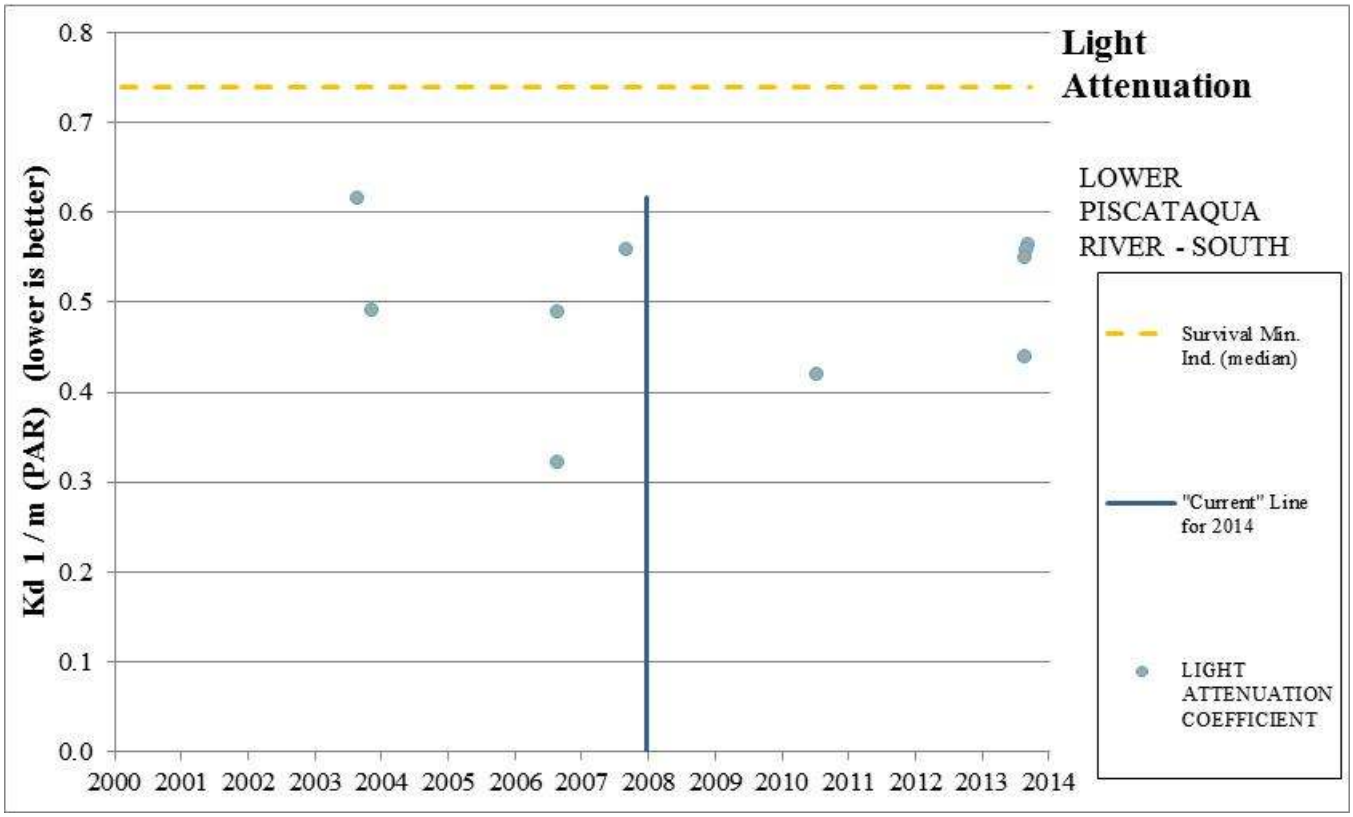
(NHEST600031001-02-02)

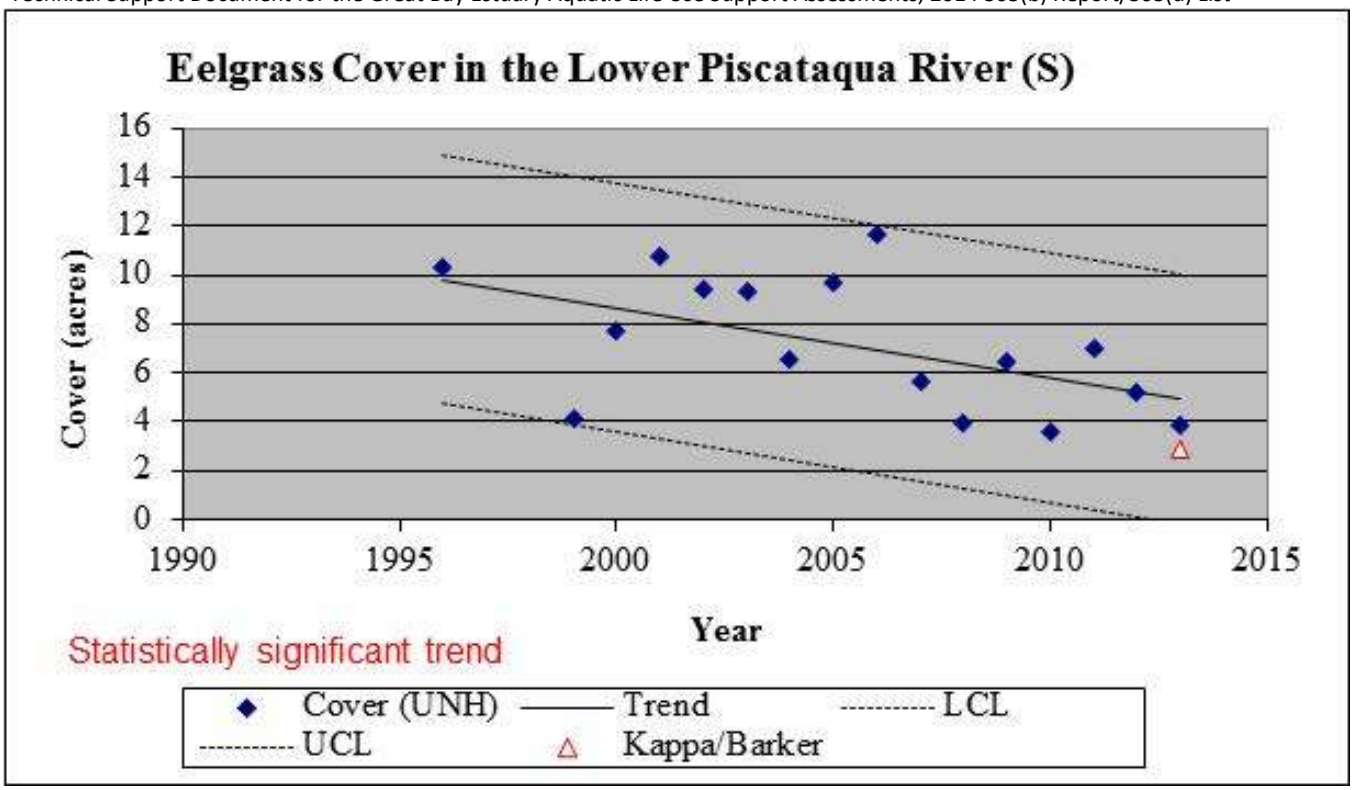
Indicator	Aquatic Life Use Category 2012 / 2014	2014
Chlorophyll-a	3-PAS / 3-PAS	The calculated 90th percentile chlorophyll-a in this assessment zone cannot be calculated due to the presence of only six measured values since 2008 (0.8 to 3.3 ug/L). The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L. The limited available data leads to an assessment of Insufficient Information – Potentially Attaining.
Dissolved Oxygen (mg/L)	2-M / 2-G	This assessment zone has only grab sample measurements for dissolved oxygen concentration in 2009 and 2010 and a datalogger deployment in 2013. During those periods no dissolved oxygen concentration measurements fell below 5 mg/L. The available data indicates that this assessment zone meets the dissolved oxygen concentration criteria.
Dissolved Oxygen (% Saturation)	3-ND / 2-G	This assessment zone has only a datalogger deployment in 2013 to compare to the dissolved oxygen percent saturation criteria. During that period no dissolved oxygen 24 hour average percent saturation measurement fell below 75 percent. The available data indicates that this assessment zone meets the dissolved oxygen percent saturation criteria.
Estuarine Bioassessments (eelgrass)	5-P / 5-P	The historical extent of eelgrass in this assessment zone was 32.5 acres from the 1948, 1962, 1980, and 1981 datasets. The median current extent of eelgrass in 2011-2013 is 5.1 acres, which is a decrease of 84.3% . Since 1990, the trend in eelgrass cover in this assessment zone is a loss of 13.6%. The thresholds for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	3-PAS / 3-PAS	Median=0.560 m^-1 (n=5). For an eelgrass restoration depth of 2 m, the light attenuation coefficient threshold is 0.75 m^-1. This assessment zone historically had eelgrass growing in both the shallows and deeper habitat making the 2m restoration depth a valid target. Therefore, the insufficient information – potentially attaining standards (3-PAS) assessment from the 2012 305(b) list has been retained.
Total Nitrogen	3-PNS / 3-PNS	The median total nitrogen from 2008 through 2013 was 513 ug/L (n=6). New Hampshire is no longer comparing ambient total nitrogen data to the total nitrogen numeric indicators used in the 2012 assessment as translators for the narrative water quality criteria. There are no documented dissolved oxygen concentration or saturation criteria exceedences in the available data. The limited chlorophyll-a data suggests that this assessment zone would meet chlorophyll-a indicator to protect dissolved oxygen. The eelgrass beds are severely degraded however the limited available light attenuation (median=0.560 m^-1 (n=5)) appears sufficient for the 2 m restoration depth. While total nitrogen is elevated there are insufficient data to indicate that the eutrophication is strong enough to warrant impairment. As such, the insufficient information-potential not supporting assessment for nitrogen has been retained.

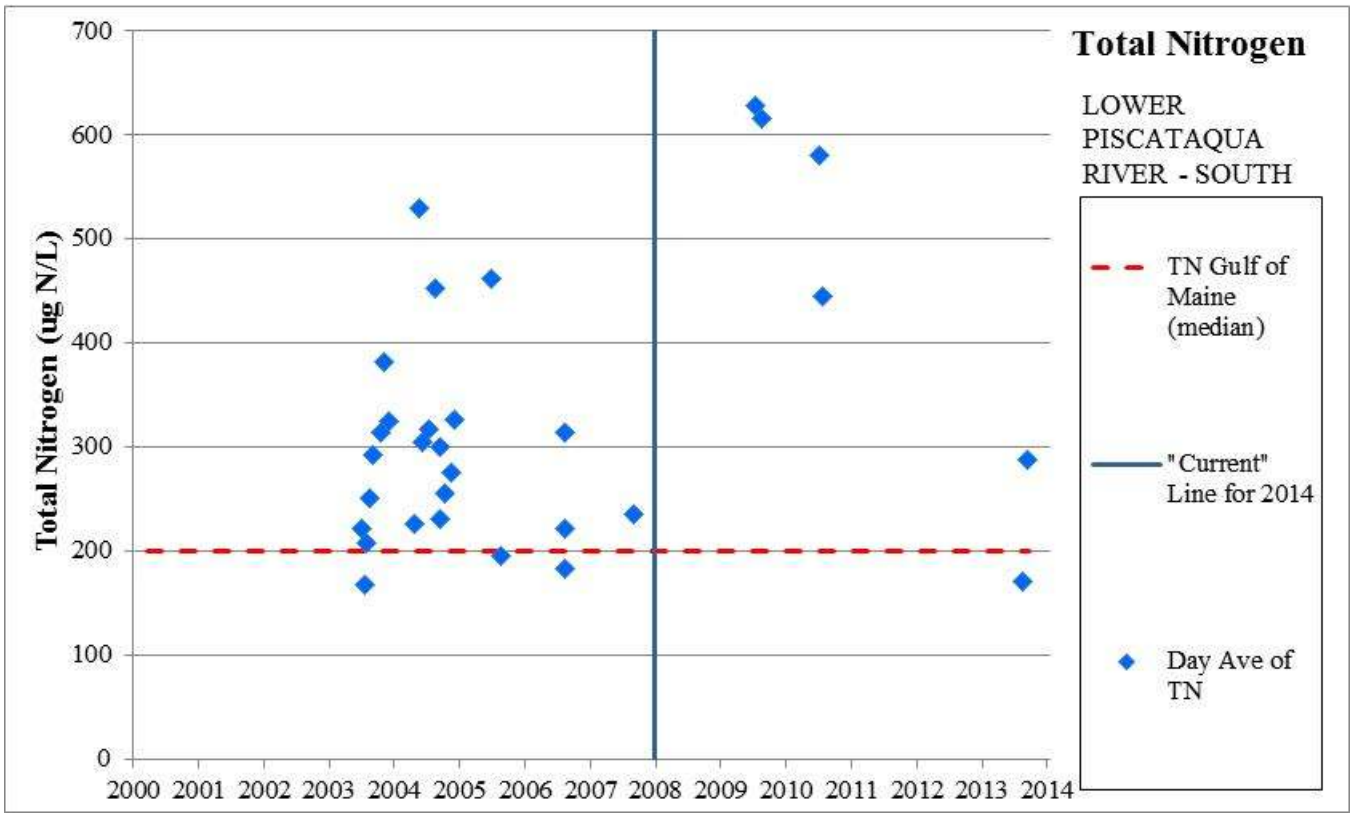

Chlorophyll-a
LOWER PISCATAQUA RIVER - SOUTH
ug Chl-a / L
Chl-a Ind. (90th percentile)
"Current" Line for 2014
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN
0
2
4
6
8
10
12
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014


Dissolved Oxygen Concentration
LOWER PISCATAQUA RIVER - SOUTH
Dissolved Oxygen, mg / L
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2014
DO-PPM-24HR-MIN-CP
DO-PPM-GRAB-CP
DO-PPM-GRAB-NCP
0
2
4
6
8
10
12
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014


Dissolved Oxygen Percent Saturation
LOWER PISCATAQUA RIVER - SOUTH
Dissolved Oxygen, Percent Saturation
120
100
80
60
40
20
0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2014
DO-PERC-24H-MEAN-CP


Light Attenuation
LOWER PISCATAQUA RIVER - SOUTH
Kd 1 / m (PAR) (lower is better)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Survival Min. Ind. (median)
"Current" Line for 2014
LIGHT ATTENUATION COEFFICIENT


Eelgrass Cover in the Lower Piscataqua River (S)
Cover (acres)
16
14
12
10
8
6
4
2
0
1990
1995
2000
2005
2010
2015
Year
Statistically significant trend
Cover (UNH)
Trend
LCL
UCL
Kappa/Barker

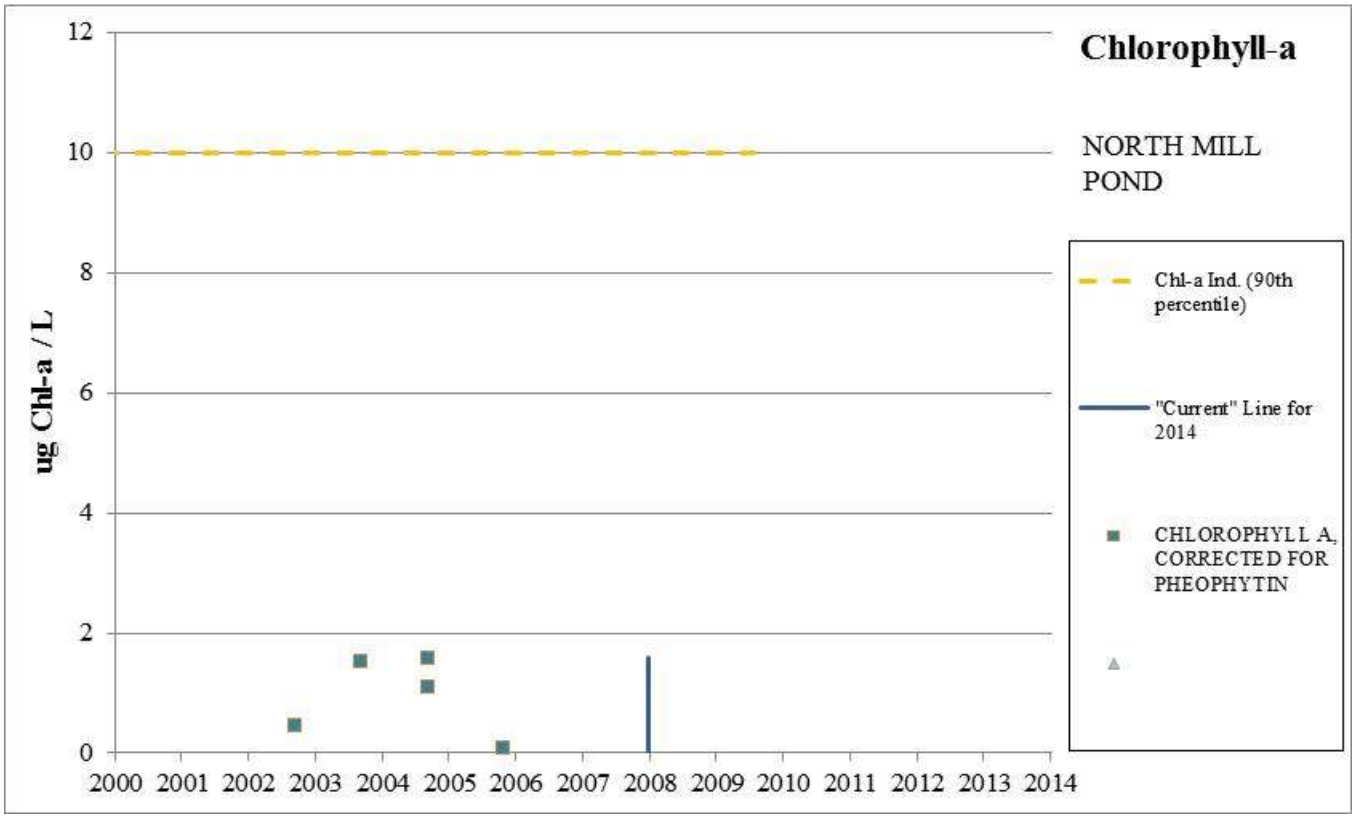

Total Nitrogen
LOWER PISCATAQUA RIVER - SOUTH
Total Nitrogen (ug N/L)
700
600
500
400
300
200
100
0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
TN Gulf of Maine (median)
"Current" Line for 2014
Day Ave of TN

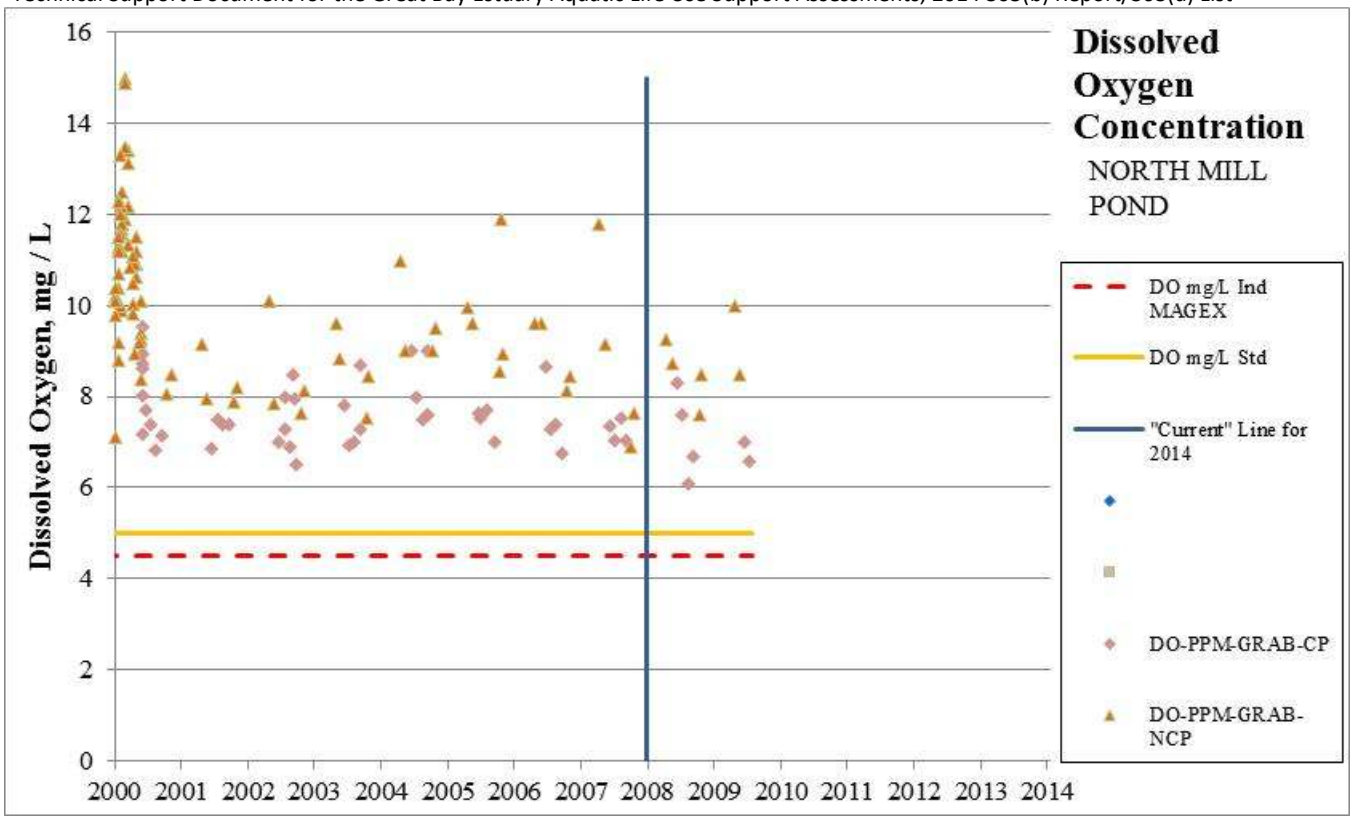
Lower Piscataqua River - South Assessment Zone (January 1, 2008 to November 7, 2014)	**Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	9	0.8	1.4	**3.3**	3.3
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	-	-	-	-	-
CHLOROPHYLL A, combined	9	0.8	1.4	3.3	3.3
DO-PERC-24H-MEAN-CP	26	87.1	99.3	113.6	116.9
DO-PERC-24H-MEAN-NCP	-	-	-	-	-
DO-PERC-2TIDE-GRAB-CP	-	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP	-	-	-	-	-
DO-PPM-24HR-MIN-CP	24	7.1	7.8	8.3	8.8
DO-PPM-24HR-MIN-NCP	-	-	-	-	-
DO-PPM-GRAB-CP	4	4.7	6.3	-	8.0
DO-PPM-GRAB-NCP	-	-	-	-	-
LIGHT ATTENUATION COEFFICIENT	5	0.430	**0.560**	-	0.575
TURBIDITY	29	5.0	13.6	49.9	67.9
Day Ave of TN	6	170	**513**	-	628
Day Ave of TDN	6	140	322	-	555
Day Ave of DIN (NH3 + NO2/3)	6	10	133	-	244
Day Ave of NH3	6	5	22	-	162
Day Ave of PON	4	30	133	-	208
Day Ave of NO2/3	6	2	56	-	162

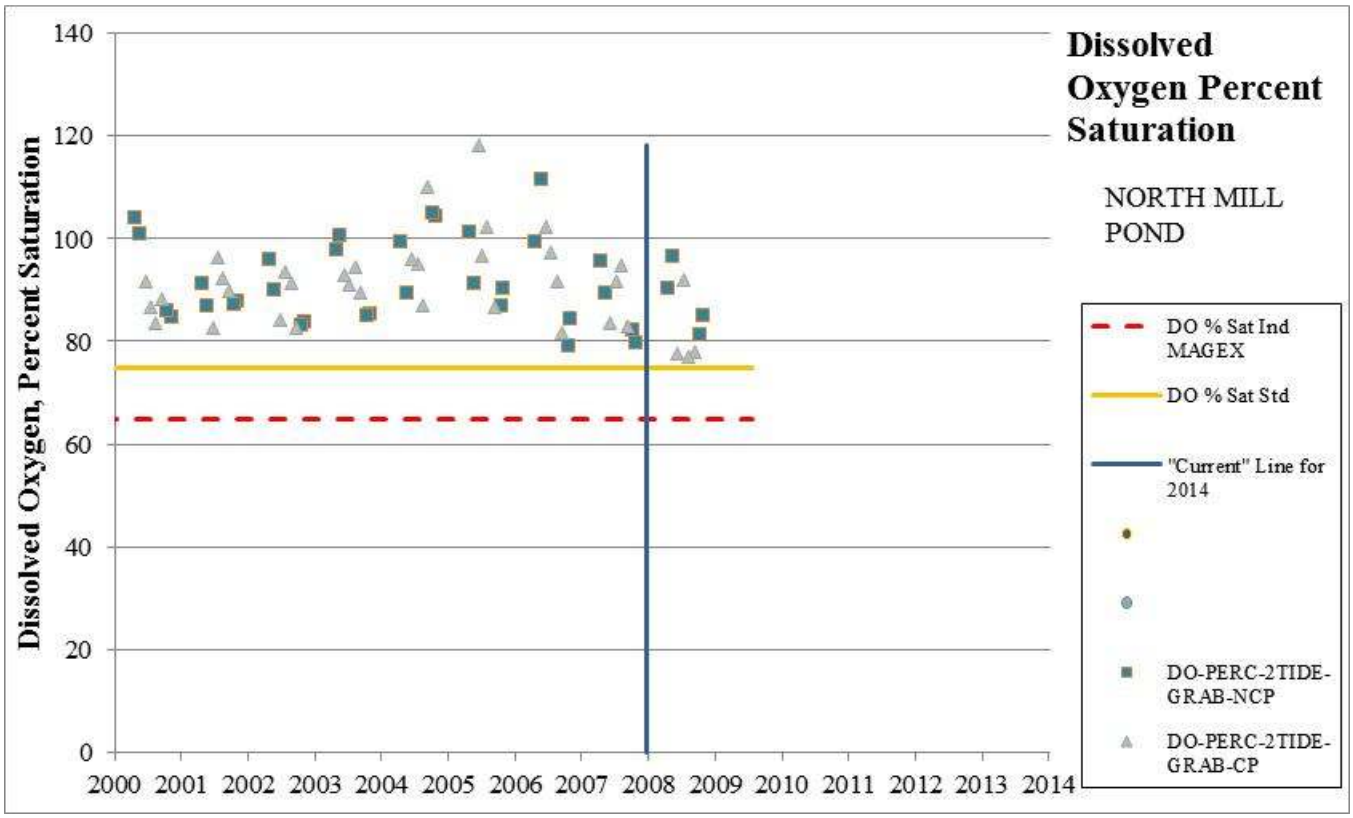
Assessment Zone = NORTH MILL POND

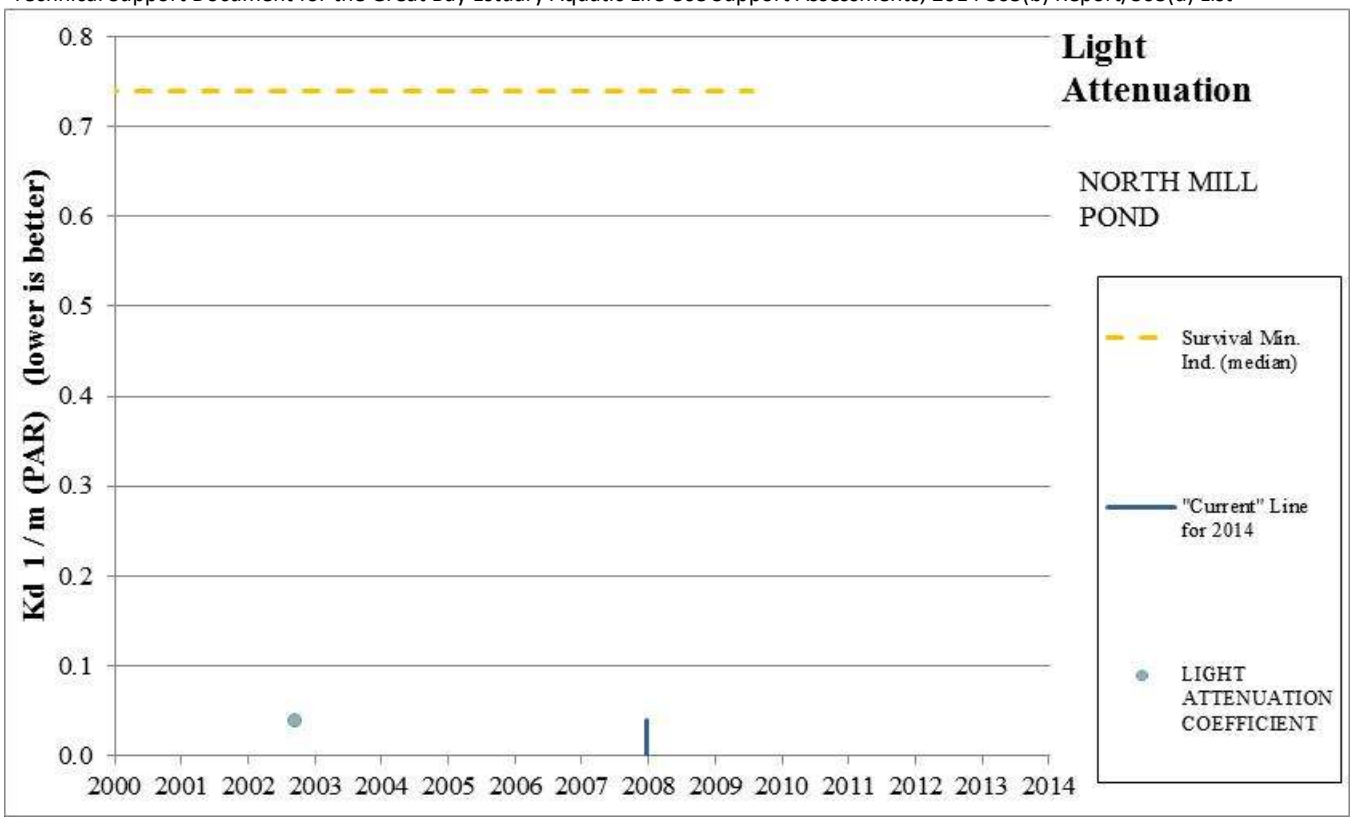
(NHEST600031001-10)

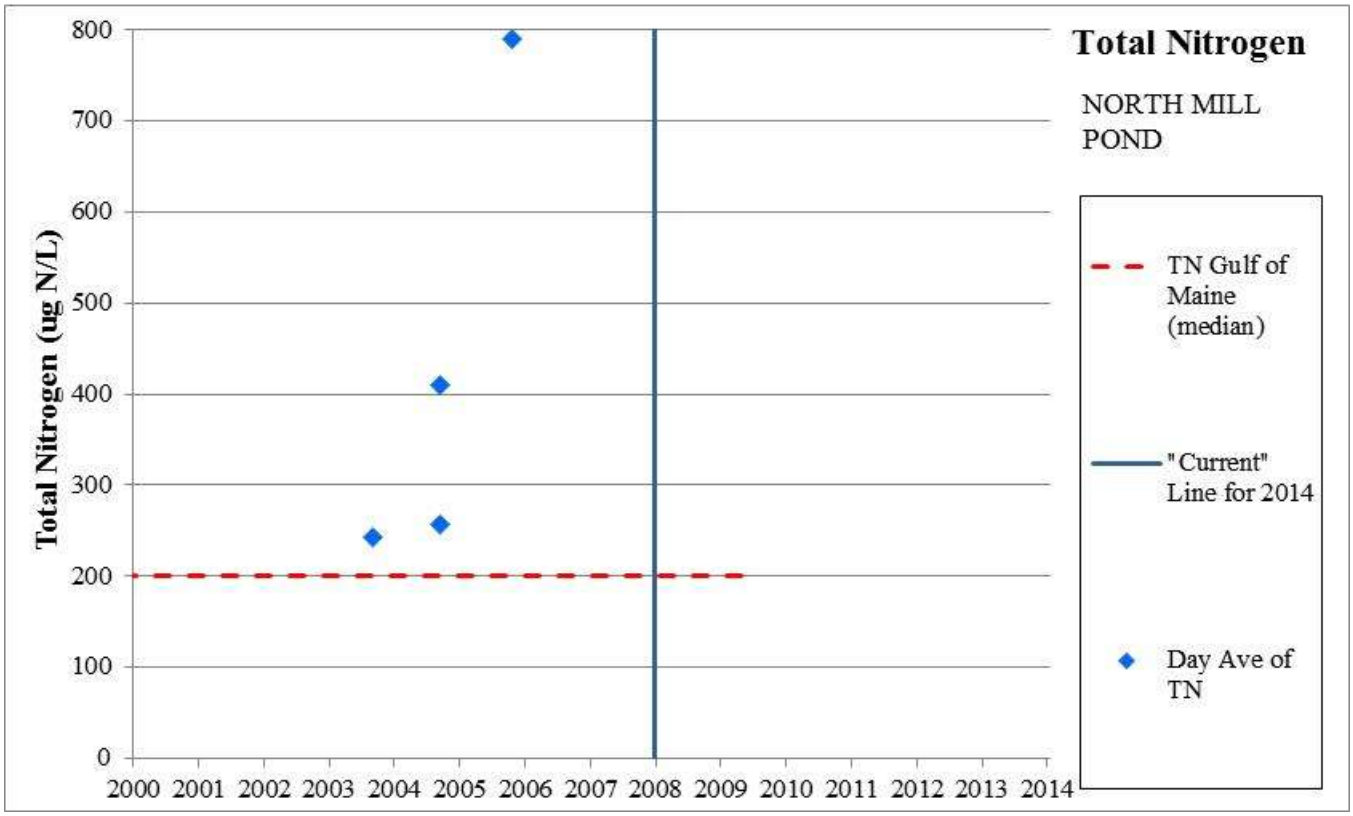
Indicator	Aquatic Life Use Category 2012 / 2014	2014
Chlorophyll-a	3-ND / 3-ND	The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L. However, there is no chlorophyll-a data for this assessment zone.
Dissolved Oxygen (mg/L)	2-G / 2-G	This assessment zone has only grab sample measurements for dissolved oxygen concentration and those measurements were only collected up through 2009. The available data indicates that this assessment zone meets the dissolved oxygen concentration criteria.
Dissolved Oxygen (% Saturation)	2-G / 2-G	This assessment zone has only grab sample measurements for dissolved oxygen 24 hour average percent saturation and those measurements were only collected up through 2008. The available data indicates that this assessment zone meets the dissolved oxygen percent saturation criteria.
Estuarine Bioassessments (eelgrass)	3-ND / 3-ND	No data.
Water Clarity (Light Attenuation Coefficient)	3-ND / 3-ND	No data.
Total Nitrogen	3-ND / 3-ND	No data.




Dissolved Oxygen Concentration
NORTH MILL POND
Dissolved Oxygen, mg / L
0
2
4
6
8
10
12
14
16
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2014
DO-PPM-GRAB-CP
DO-PPM-GRAB-NCP


Dissolved Oxygen Percent Saturation
NORTH MILL POND
Dissolved Oxygen, Percent Saturation
0
20
40
60
80
100
120
140
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2014
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP


Light Attenuation
NORTH MILL POND
Kd 1 / m (PAR) (lower is better)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Survival Min. Ind. (median)
"Current" Line for 2014
LIGHT ATTENUATION COEFFICIENT

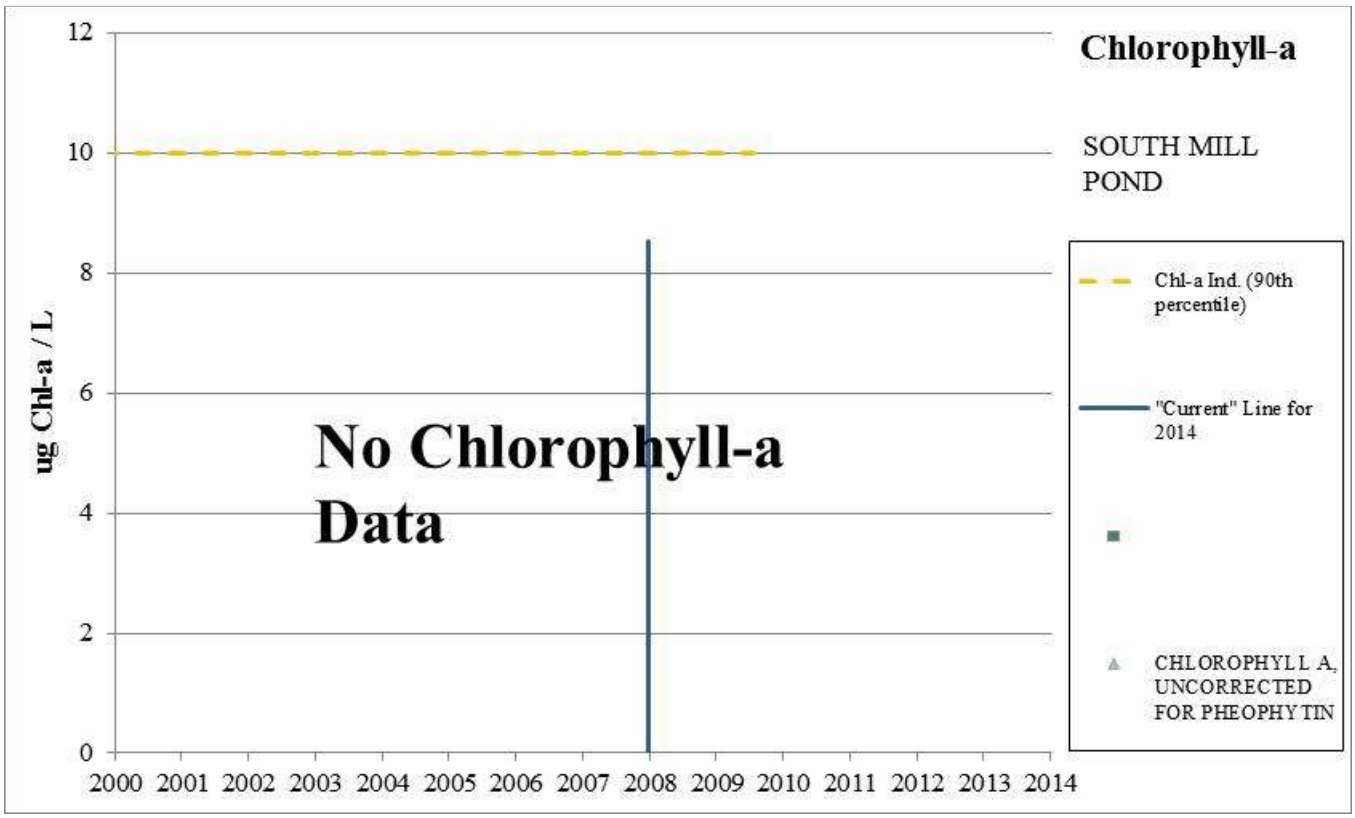

Total Nitrogen
NORTH MILL POND
Total Nitrogen (ug N/L)
800
700
600
500
400
300
200
100
0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
TN Gulf of Maine (median)
"Current" Line for 2014
Day Ave of TN

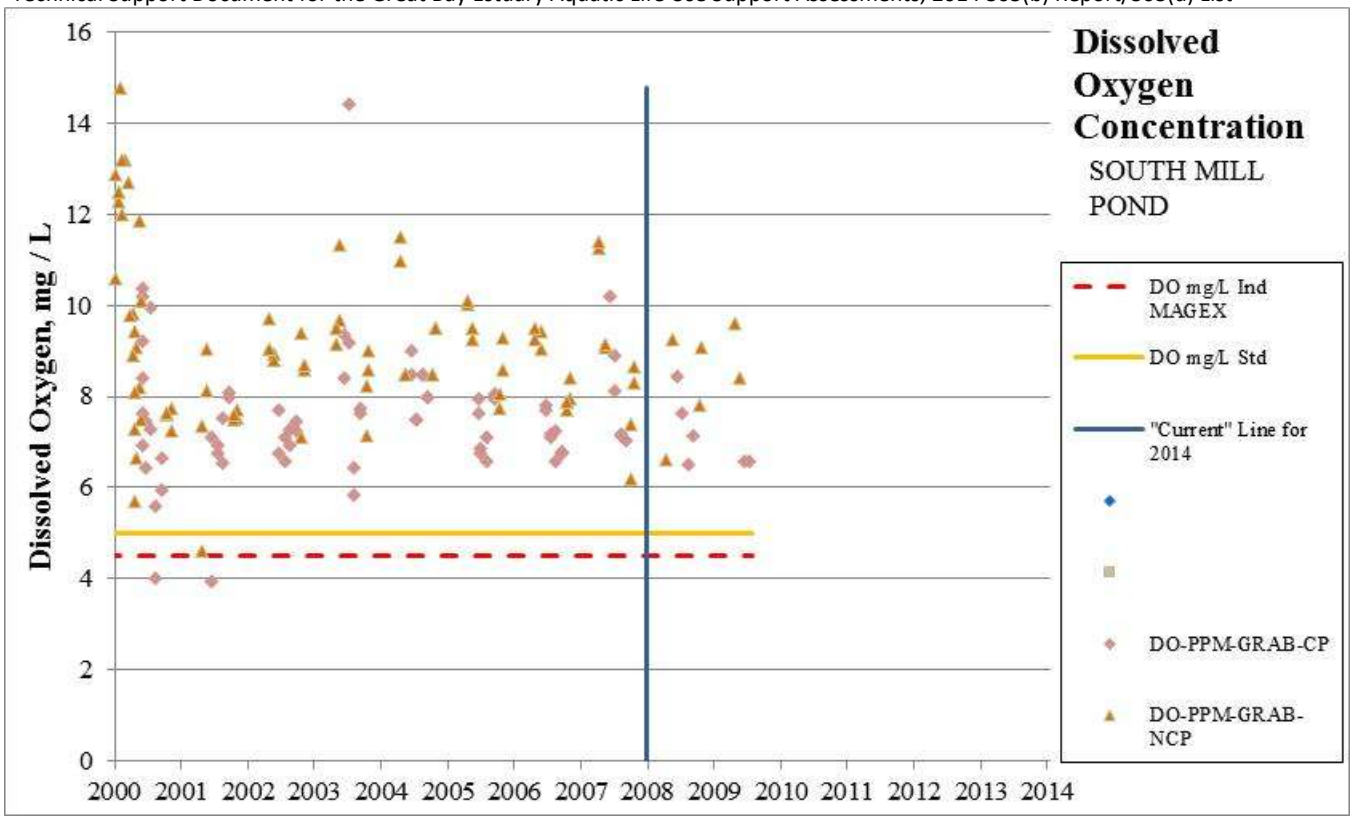
North Mill Pond Assessment Zone (January 1, 2008 to November 7, 2014)	**Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	-	-	-	-	-
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	-	-	-	-	-
CHLOROPHYLL A, combined	-	-	-	-	-
DO-PERC-24H-MEAN-CP	-	-	-	-	-
DO-PERC-24H-MEAN-NCP	-	-	-	-	-
DO-PERC-2TIDE-GRAB-CP	4	76.9	77.9	-	92.2
DO-PERC-2TIDE-GRAB-NCP	4	81.5	87.9	-	96.8
DO-PPM-24HR-MIN-CP	-	-	-	-	-
DO-PPM-24HR-MIN-NCP	-	-	-	-	-
DO-PPM-GRAB-CP	6	6.1	6.9	-	8.3
DO-PPM-GRAB-NCP	6	7.6	8.6	-	10.0
LIGHT ATTENUATION COEFFICIENT	-	-	-	-	-
TURBIDITY	-	-	-	-	-
Day Ave of TN	-	-	-	-	-
Day Ave of TDN	-	-	-	-	-
Day Ave of DIN (NH3 + NO2/3)	-	-	-	-	-
Day Ave of NH3	-	-	-	-	-
Day Ave of PON	-	-	-	-	-
Day Ave of NO2/3	-	-	-	-	-

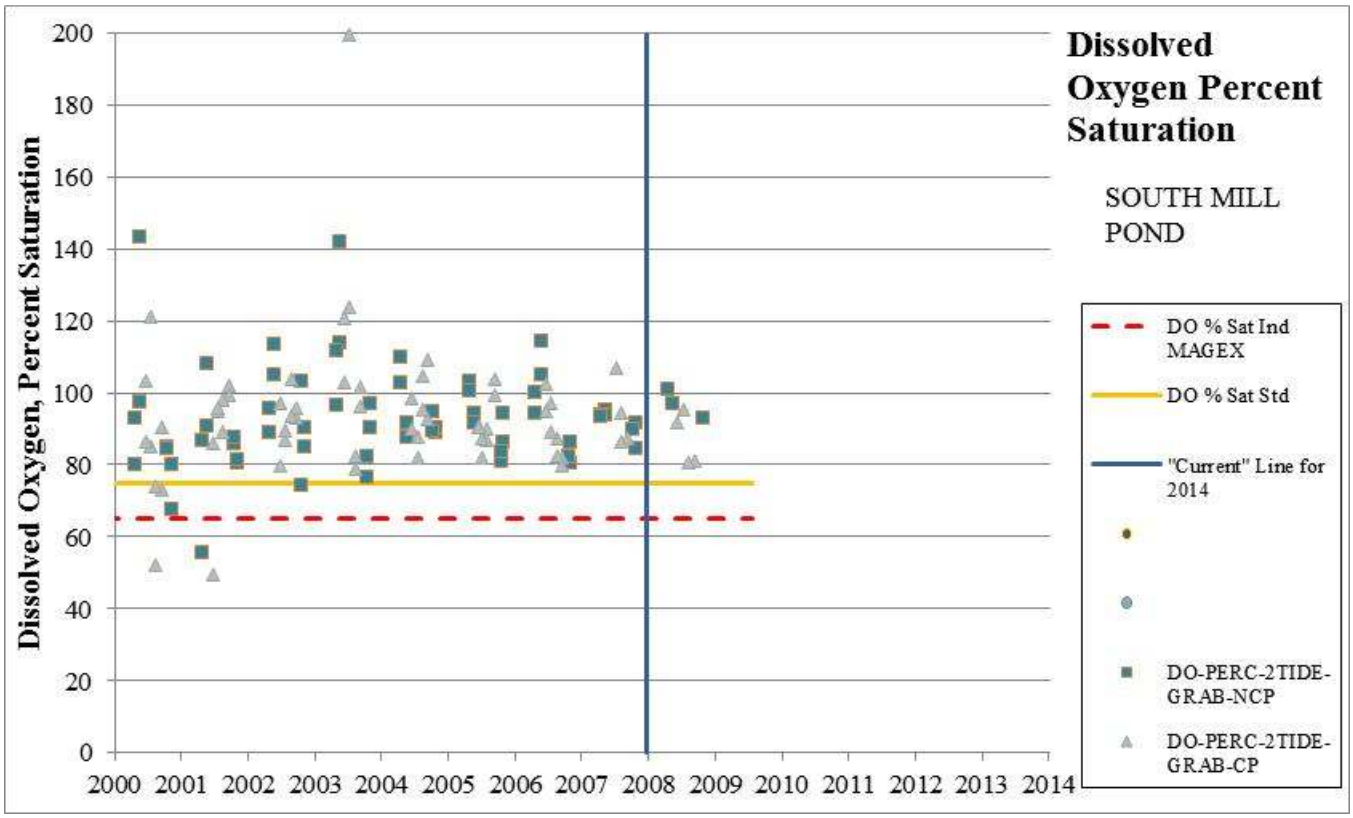
Assessment Zone = SOUTH MILL POND

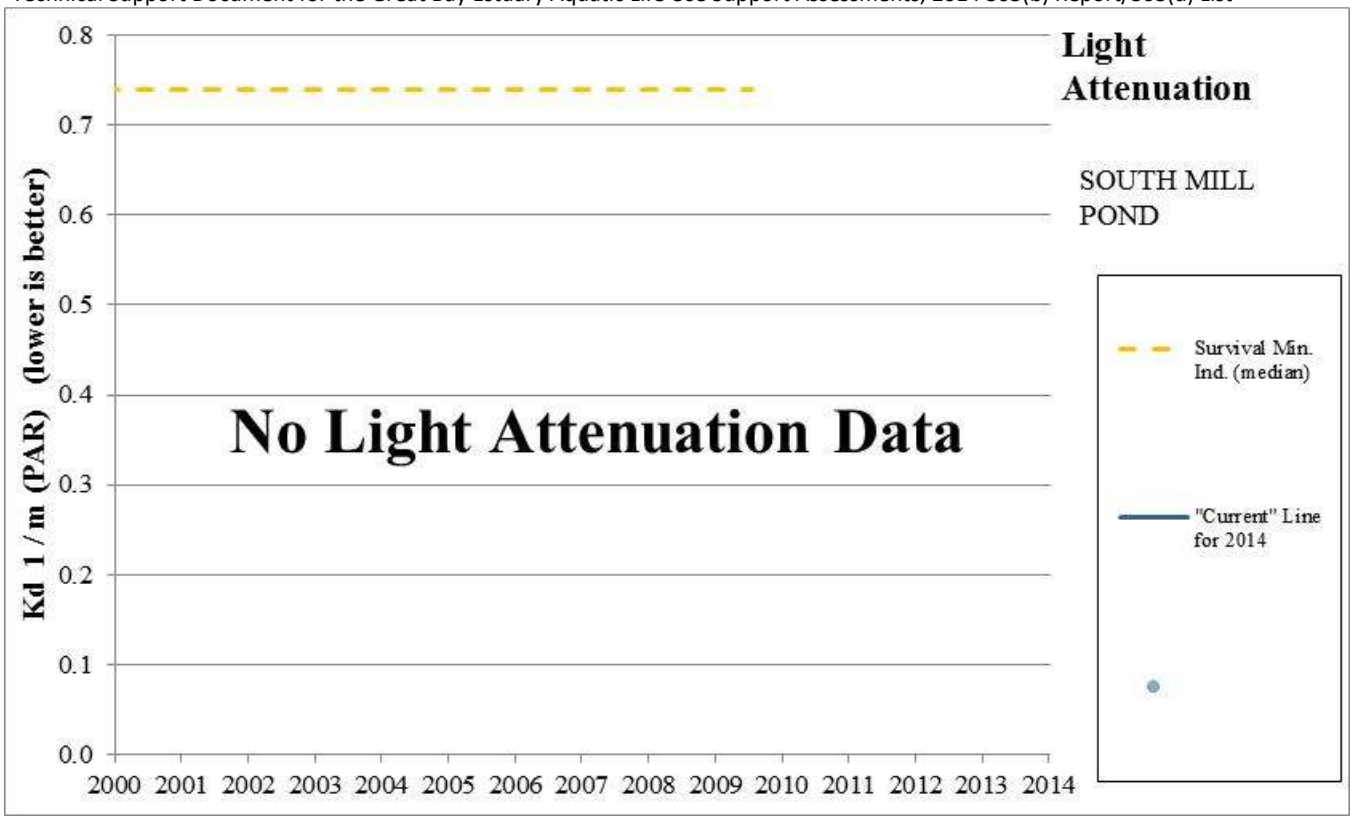
(NHEST600031001-09)

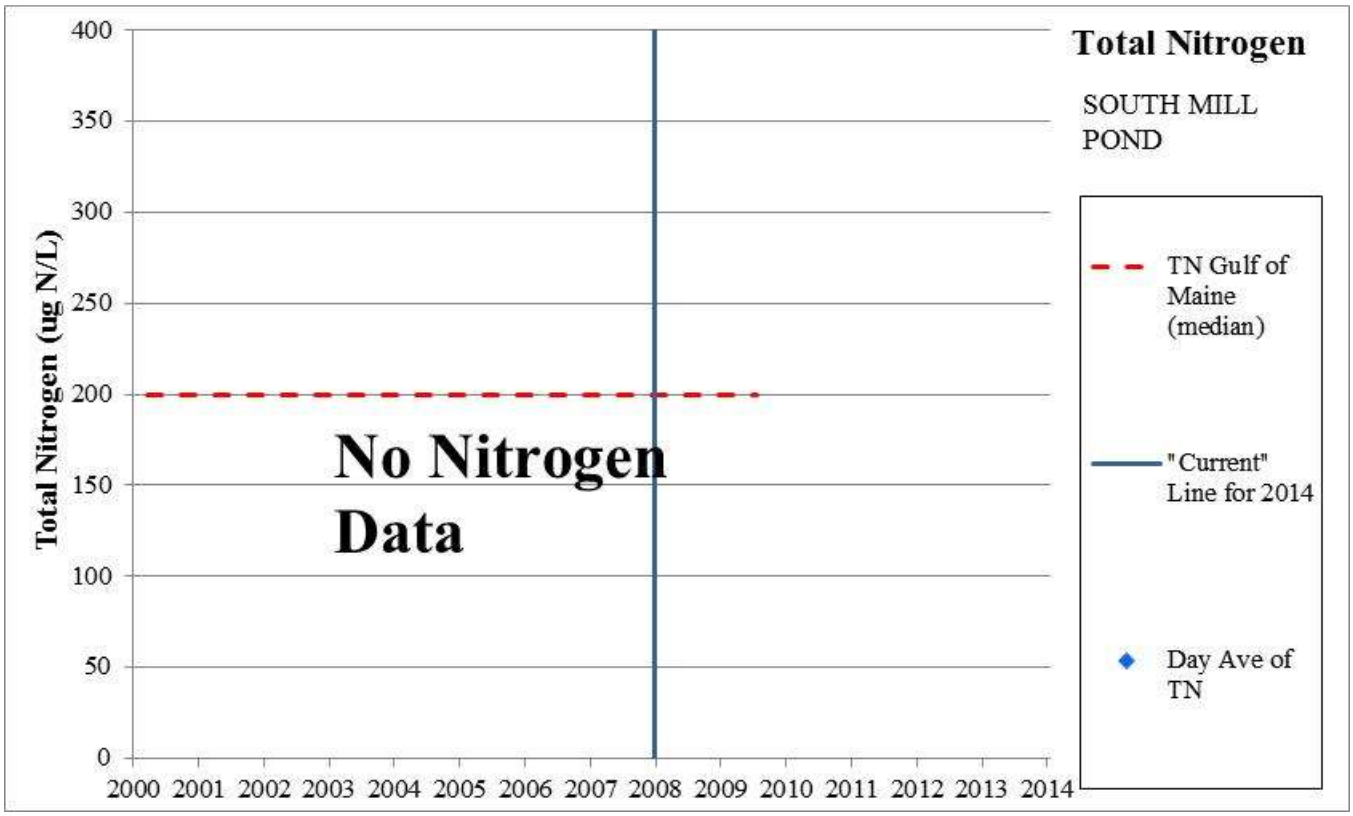
Indicator	Aquatic Life Use Category 2012 / 2014	2014
Chlorophyll-a	3-ND / 3-ND	The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L. However, there is no chlorophyll-a data for this assessment zone.
Dissolved Oxygen (mg/L)	2-M / 2-G	This assessment zone has only grab sample measurements for dissolved oxygen concentration and those measurements were only collected up through 2009. That available data indicates that this assessment zone meets the dissolved oxygen criteria.
Dissolved Oxygen (% Saturation)	2-G / 2-G	This assessment zone has only grab sample measurements for dissolved oxygen 24 hour average percent saturation and those measurements were only collected up through 2008. That available data indicates that this assessment zone meets the dissolved oxygen criteria.
Estuarine Bioassessments (eelgrass)	3-ND / 3-ND	No data.
Water Clarity (Light Attenuation Coefficient)	3-ND / 3-ND	No data.
Total Nitrogen	3-ND / 3-ND	No data.




Dissolved Oxygen Concentration
SOUTH MILL POND
Dissolved Oxygen, mg / L
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2014
DO-PPM-GRAB-CP
DO-PPM-GRAB-NCP


Dissolved Oxygen Percent Saturation
SOUTH MILL POND
Dissolved Oxygen, Percent Saturation
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2014
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP


Light Attenuation
SOUTH MILL POND
Kd 1 / m (PAR) (lower is better)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
No Light Attenuation Data
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Survival Min. Ind. (median)
"Current" Line for 2014

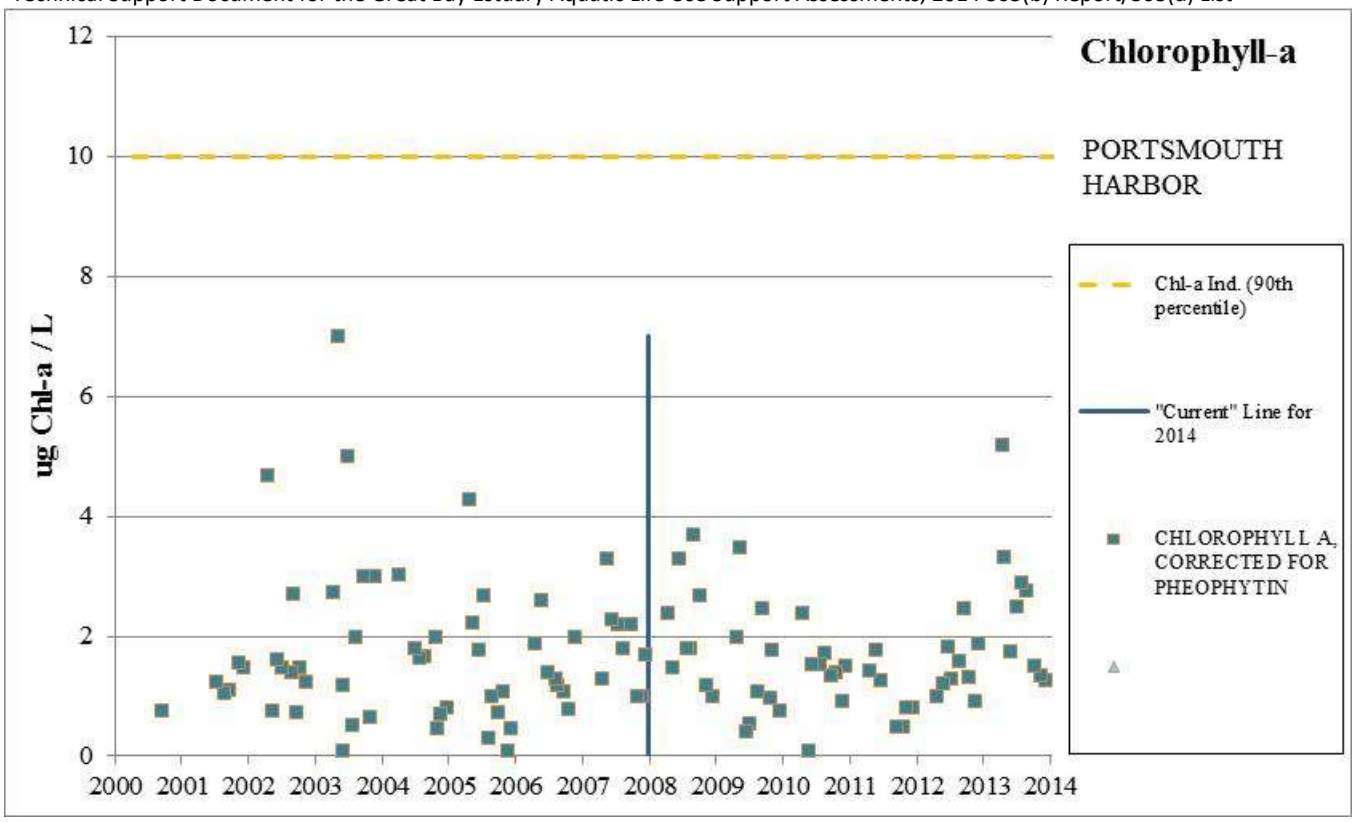

Total Nitrogen
SOUTH MILL POND
Total Nitrogen (ug N/L)
400
350
300
250
200
150
100
50
0
No Nitrogen Data
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
TN Gulf of Maine (median)
"Current" Line for 2014
Day Ave of TN

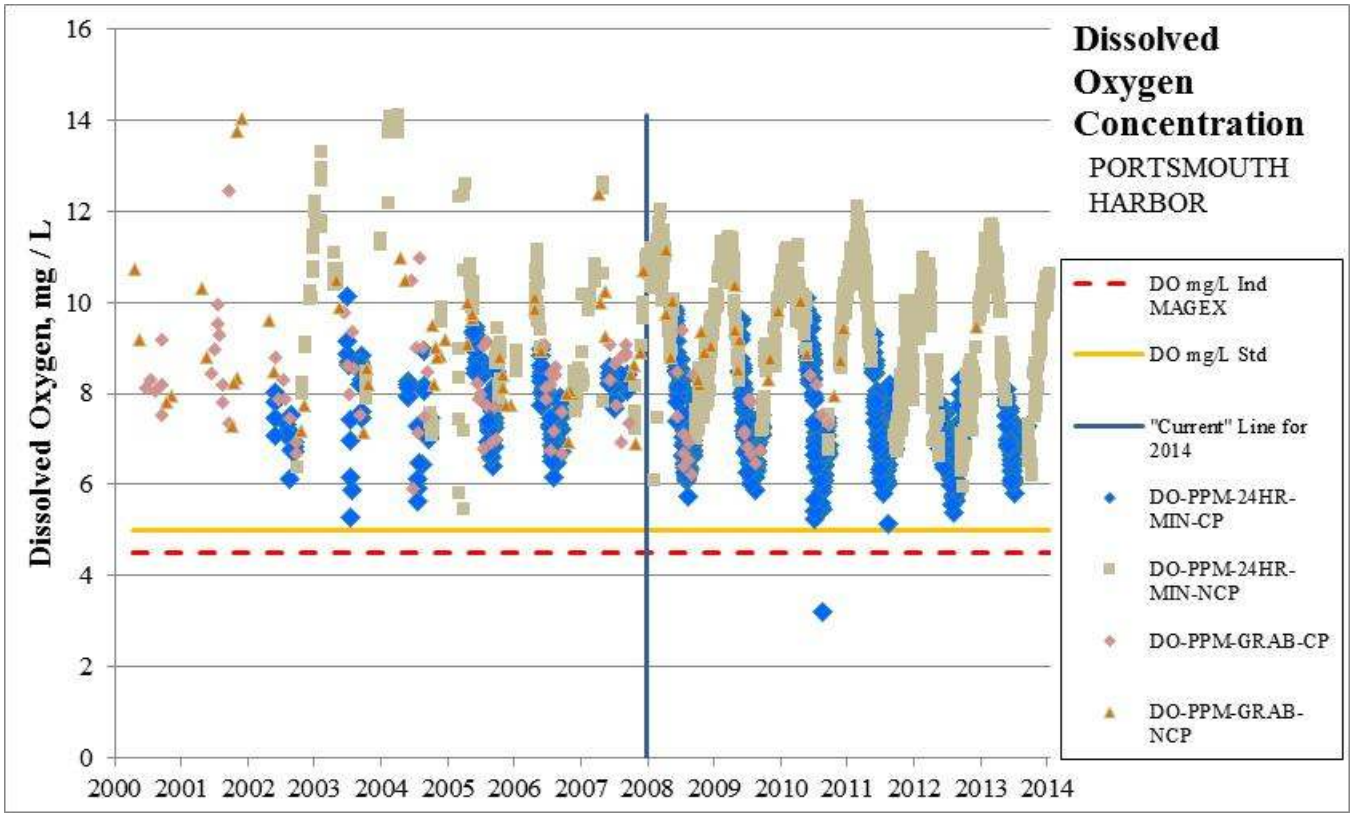
South Mill Pond Assessment Zone (January 1, 2008 to November 7, 2014)	**Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	-	-	-	-	-
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	-	-	-	-	-
CHLOROPHYLL A, combined	-	-	-	-	-
DO-PERC-24H-MEAN-CP	-	-	-	-	-
DO-PERC-24H-MEAN-NCP	-	-	-	-	-
DO-PERC-2TIDE-GRAB-CP	4	80.7	86.5	-	95.4
DO-PERC-2TIDE-GRAB-NCP	3	93.0	97.1	-	101.0
DO-PPM-24HR-MIN-CP	-	-	-	-	-
DO-PPM-24HR-MIN-NCP	-	-	-	-	-
DO-PPM-GRAB-CP	6	6.5	6.9	-	8.5
DO-PPM-GRAB-NCP	6	6.6	8.8	-	9.6
LIGHT ATTENUATION COEFFICIENT	-	-	-	-	-
TURBIDITY	-	-	-	-	-
Day Ave of TN	-	-	-	-	-
Day Ave of TDN	-	-	-	-	-
Day Ave of DIN (NH3 + NO2/3)	-	-	-	-	-
Day Ave of NH3	-	-	-	-	-
Day Ave of PON	-	-	-	-	-
Day Ave of NO2/3	-	-	-	-	-

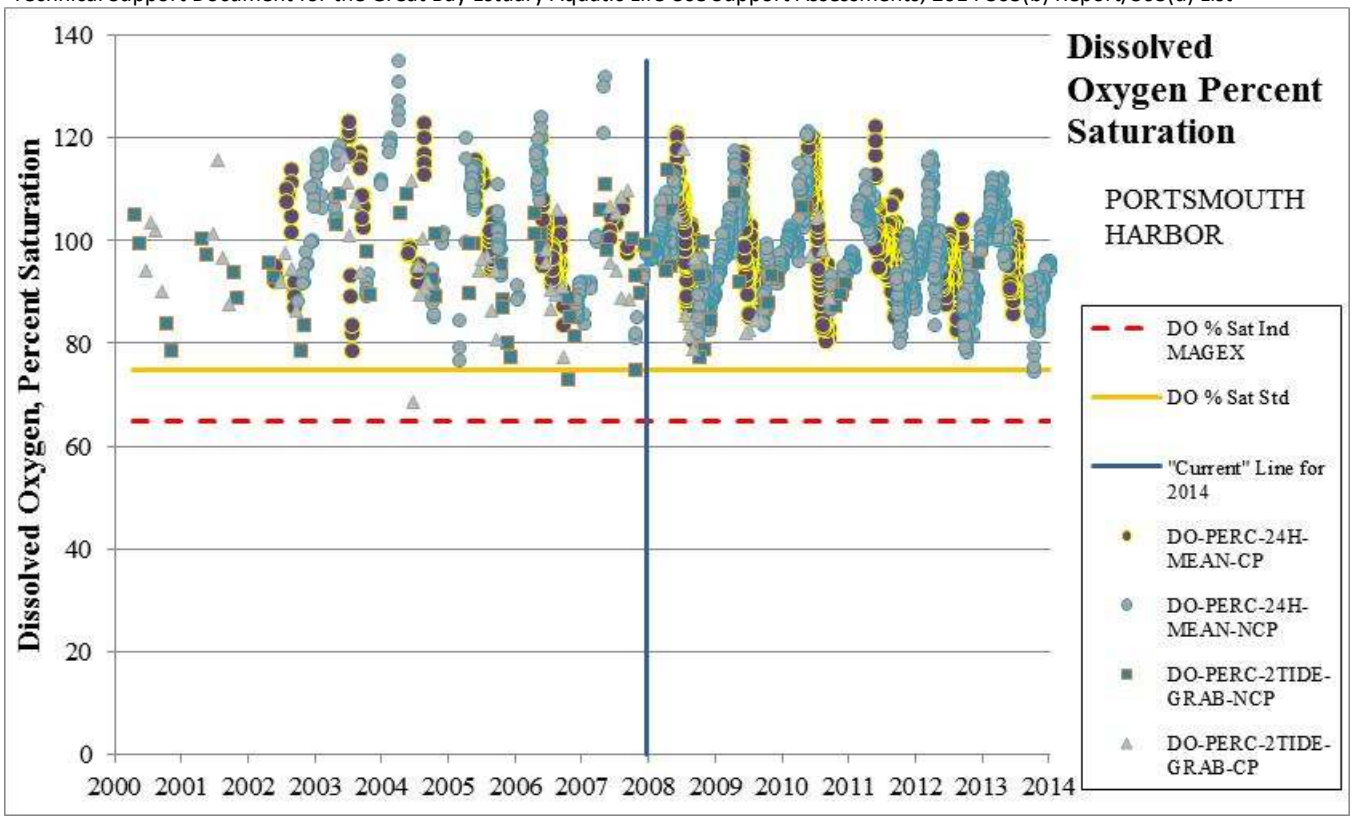
Assessment Zone = PORTSMOUTH HARBOR

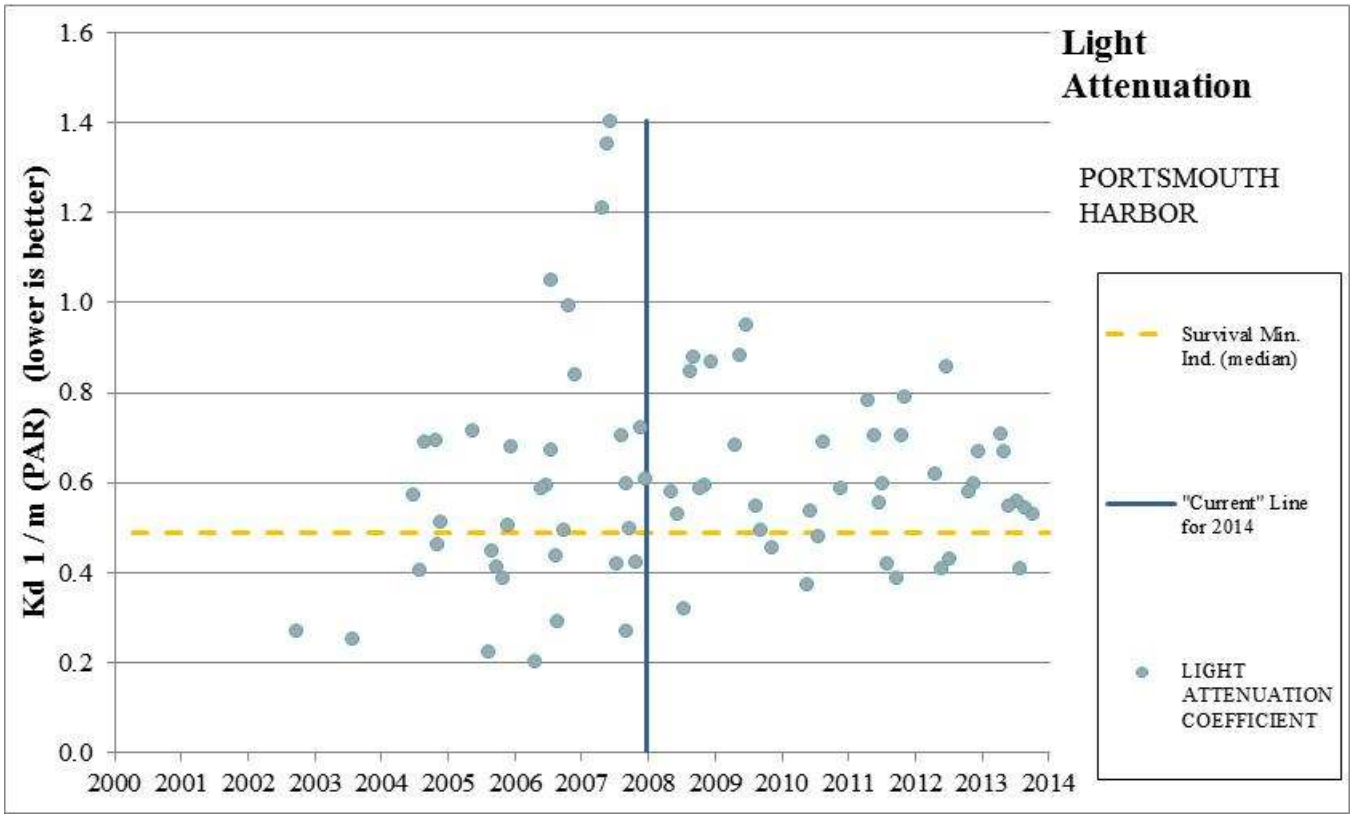
(NHEST600031001-11)

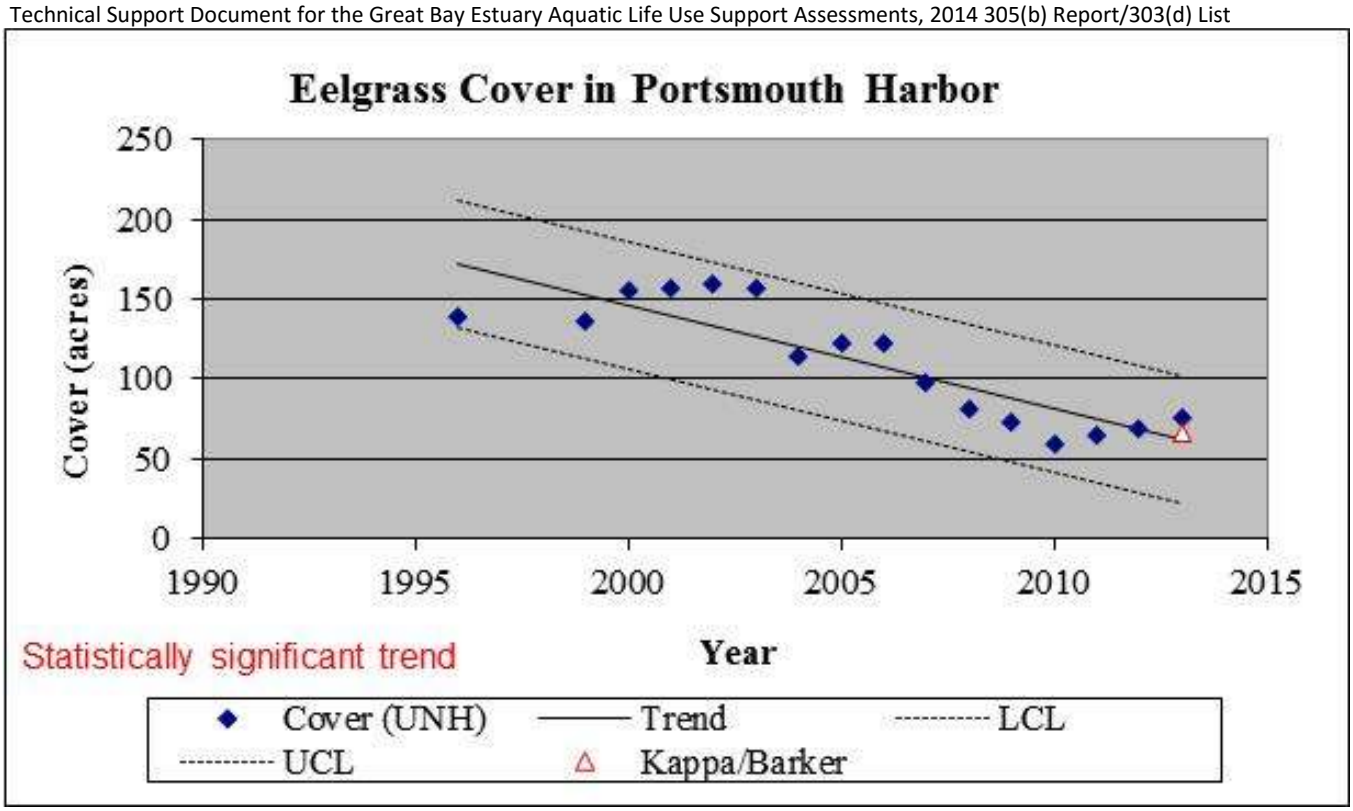
Indicator	Aquatic Life Use Category 2012 / 2014	2014
Chlorophyll-a	2-G / 2-G	The calculated 90th percentile chlorophyll-a in this assessment zone is 3.2 ug/L (n = 52) and a maximum reading of 5.2 ug/L. The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L.
Dissolved Oxygen (mg/L)	2-M / 2-M	This assessment zone has datalogger and grab measurements for dissolved oxygen concentration covering 2008 through 2013. Only one sample appears to fall below 5 mg/L. The available data indicates that this assessment zone meets the dissolved oxygen concentration criteria.
Dissolved Oxygen (% Saturation)	2-G / 2-M	This assessment zone has 24 hour average datalogger and grab measurements for dissolved oxygen percent saturation covering 2008 through 2013. Only one 24 hour average appears to fall below 75 percent saturation. The available data indicates that this assessment zone meets the dissolved oxygen percent saturation criteria.
Estuarine Bioassessments (eelgrass)	5-P / 5-P	The historical extent of eelgrass in this assessment zone was 227.7 acres from the 1948, 1962, 1980, and 1981 datasets. The median current extent of eelgrass in 2011-2013 is 68.5 acres, which is a decrease of 58.2%. Since 1990, the trend in eelgrass cover in this assessment zone is a loss of 35.9%. The thresholds for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	5-M / 5-M	Median=0.600 m^-1 (n=41). For an eelgrass restoration depth of 3 m, the light attenuation coefficient threshold is 0.5 m^-1. This assessment zone historically had eelgrass growing in both the shallows and deeper habitat making the 3m restoration depth a valid target. Further, a review of the location of the deep edge of the eelgrass suggests that the maximum depth of eelgrass survival is not as deep as it was in the past. Due to the proximity of the Portsmouth WWTF, this assessment zone may be experiencing a large portion of light diminishment from the large TSS load out of the discharge. Therefore, the impaired (5-M) listing from the 2012 303d list has been retained.
Total Nitrogen	5-M / 3-PNS	The median total nitrogen from 2008 through 2013 was 266 ug/L (n=56). New Hampshire is no longer comparing ambient total nitrogen data to the total nitrogen numeric indicators used in the 2012 assessment as translators for the narrative water quality criteria. In the continuous data (2008-2013) there was only one day that had a documented exceedance of the dissolved oxygen concentration and percent saturation criteria. The chlorophyll-a data indicates that this assessment zone meets the chlorophyll-a indicator to protect dissolved oxygen. The eelgrass beds are severely degraded. The available light attenuation data (median=0.600 m^-1 (n=41)) appears inadequate for the 3 m restoration depth but may be reflective the Total Suspended Solids (TSS) load from the Portsmouth WWTF. While total nitrogen is elevated above the estimated offshore total nitrogen concentration of 200 ug/L, the data suggest that Portsmouth Harbor total nitrogen is decreasing. At this time there are some of the classic indicators of nutrient eutrophication present in this assessment zone and total nitrogen remains elevated. However, there is insufficient power in the response datasets to determine that eutrophication by total nitrogen is alone is not known to be strong enough to warrant impairment under New Hampshire's narrative standard. As such, this assessment zone has been assessed as Insufficient Information – Potentially Not Supporting (3-PNS) for total nitrogen.

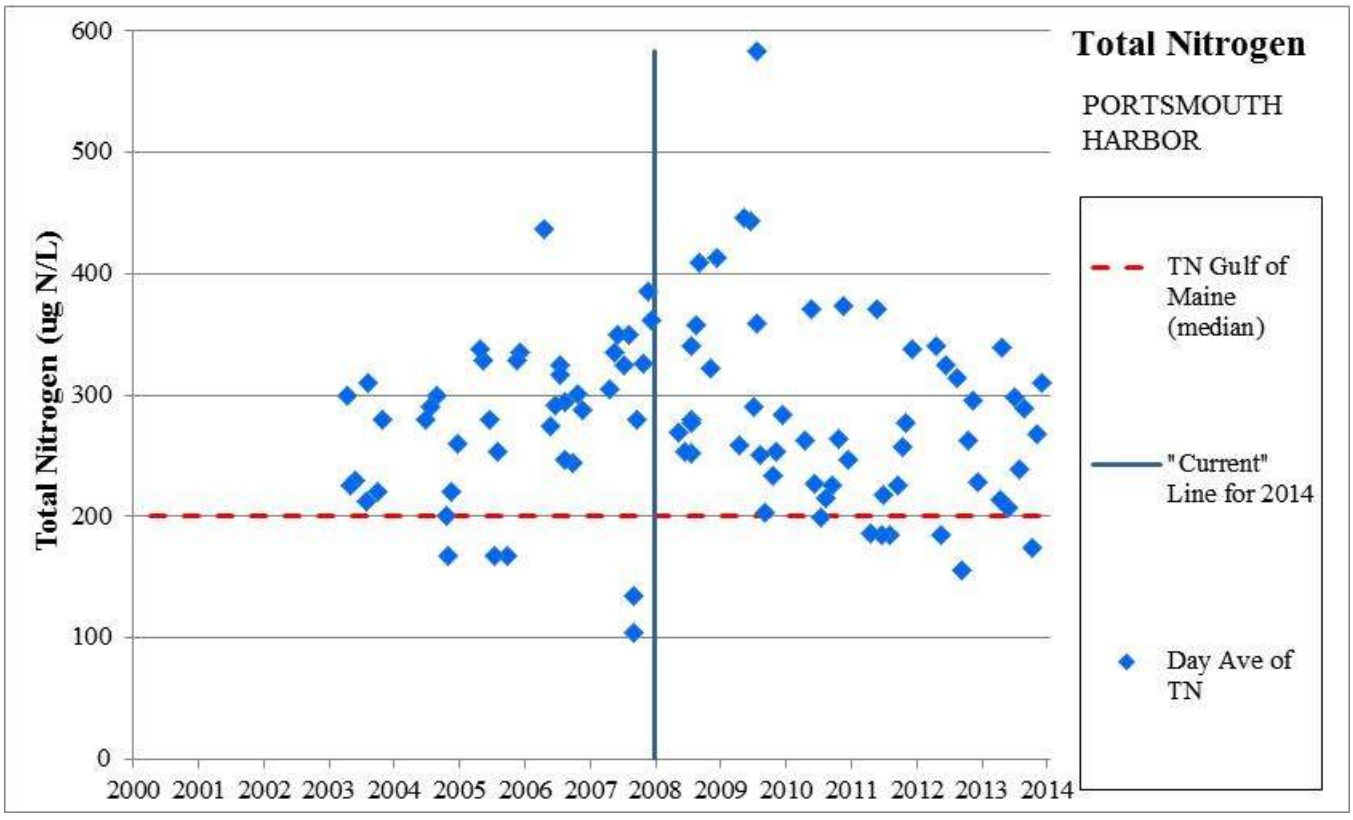

Chlorophyll-a
PORTSMOUTH HARBOR
ug Chl-a / L
0
2
4
6
8
10
12
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Chl-a Ind. (90th percentile)
"Current" Line for 2014
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN


Dissolved Oxygen Concentration
PORTSMOUTH HARBOR
Dissolved Oxygen, mg / L
0
2
4
6
8
10
12
14
16
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2014
DO-PPM-24HR-MIN-CP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP
DO-PPM-GRAB-NCP


Dissolved Oxygen Percent Saturation
PORTSMOUTH HARBOR
Dissolved Oxygen, Percent Saturation
140
120
100
80
60
40
20
0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2014
DO-PERC-24H-MEAN-CP
DO-PERC-24H-MEAN-NCP
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP


Light Attenuation
PORTSMOUTH HARBOR
Kd 1 / m (PAR) (lower is better)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Survival Min. Ind. (median)
"Current" Line for 2014
LIGHT ATTENUATION COEFFICIENT


Eelgrass Cover in Portsmouth Harbor
Cover (acres)
250
200
150
100
50
0
1990
1995
2000
2005
2010
2015
Year
Statistically significant trend
Cover (UNH)
Trend
LCL
UCL
Kappa/Barker

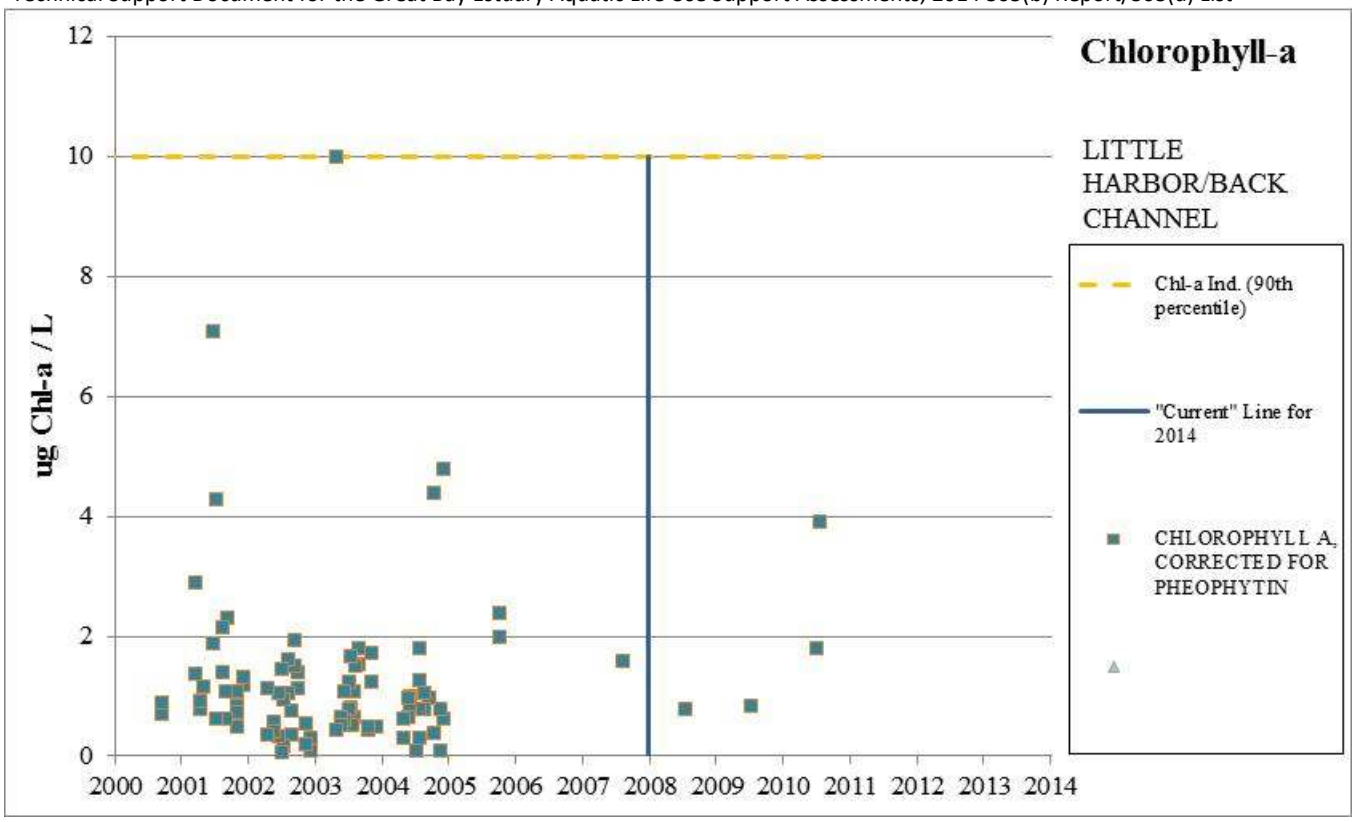

Total Nitrogen
PORTSMOUTH HARBOR
Total Nitrogen (ug N/L)
600
500
400
300
200
100
0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
TN Gulf of Maine (median)
"Current" Line for 2014
Day Ave of TN

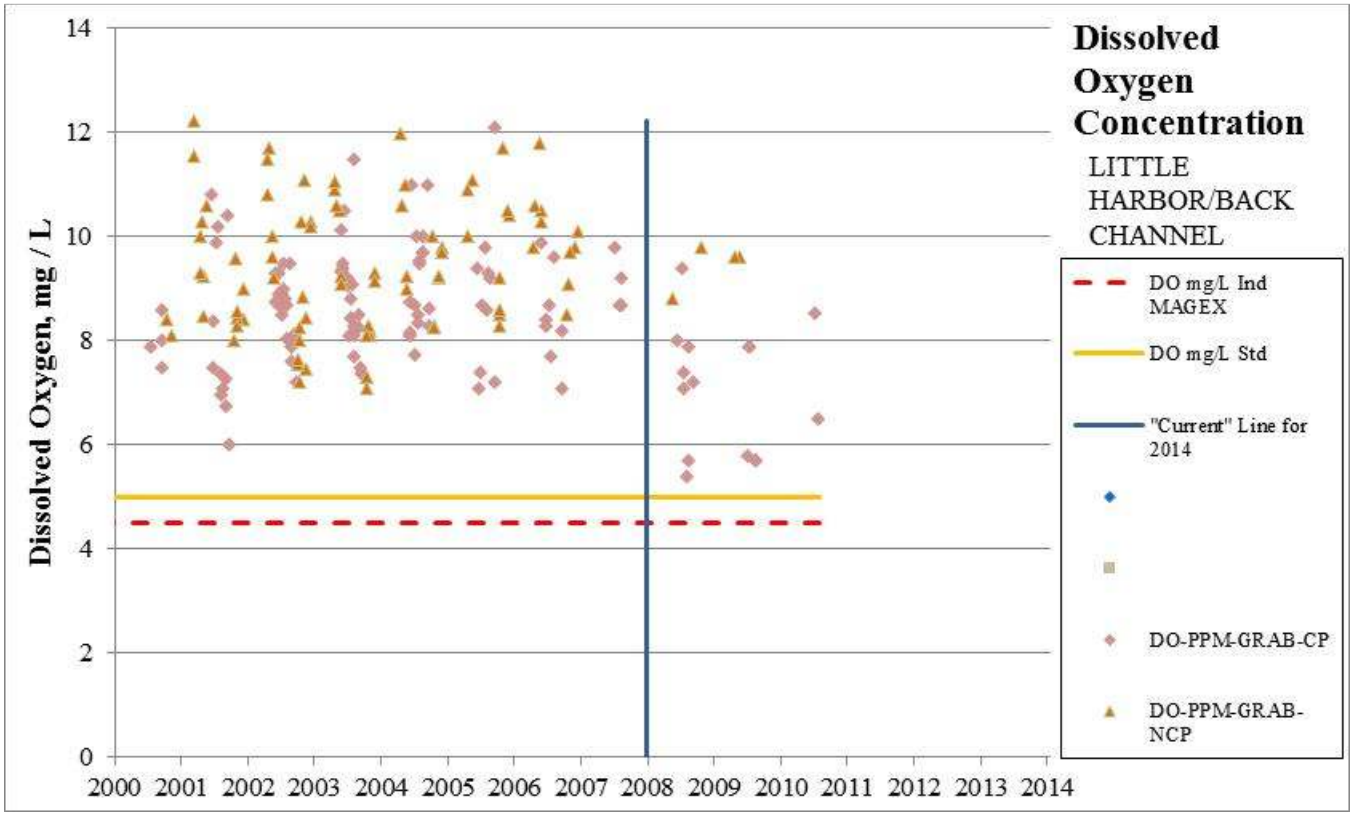
Portsmouth Harbor Assessment Zone (January 1, 2008 to November 7, 2014)	**Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	52	0.1	1.5	**3.2**	5.2
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	-	-	-	-	-
CHLOROPHYLL A, combined	52	0.1	1.5	3.2	5.2
DO-PERC-24H-MEAN-CP	653	80.4	96.1	109.9	122.3
DO-PERC-24H-MEAN-NCP	1,258	74.5	97.7	107.5	121.4
DO-PERC-2TIDE-GRAB-CP	15	78.8	85.5	110.1	117.9
DO-PERC-2TIDE-GRAB-NCP	20	77.2	93.3	109.2	113.7
DO-PPM-24HR-MIN-CP	651	3.2	7.1	8.6	10.1
DO-PPM-24HR-MIN-NCP	1,279	6.0	9.9	11.1	12.1
DO-PPM-GRAB-CP	23	6.3	7.1	8.5	9.4
DO-PPM-GRAB-NCP	22	8.0	9.1	10.3	11.2
LIGHT ATTENUATION COEFFICIENT	41	0.330	**0.600**	0.878	0.960
TURBIDITY	1,835	0.0	6.2	53.3	1,873.2
Day Ave of TN	56	156	**266**	384	583
Day Ave of TDN	58	88	207	326	505
Day Ave of DIN (NH3 + NO2/3)	56	13	121	252	418
Day Ave of NH3	56	3	37	201	283
Day Ave of PON	-	-	-	-	-
Day Ave of NO2/3	59	3	45	136	186

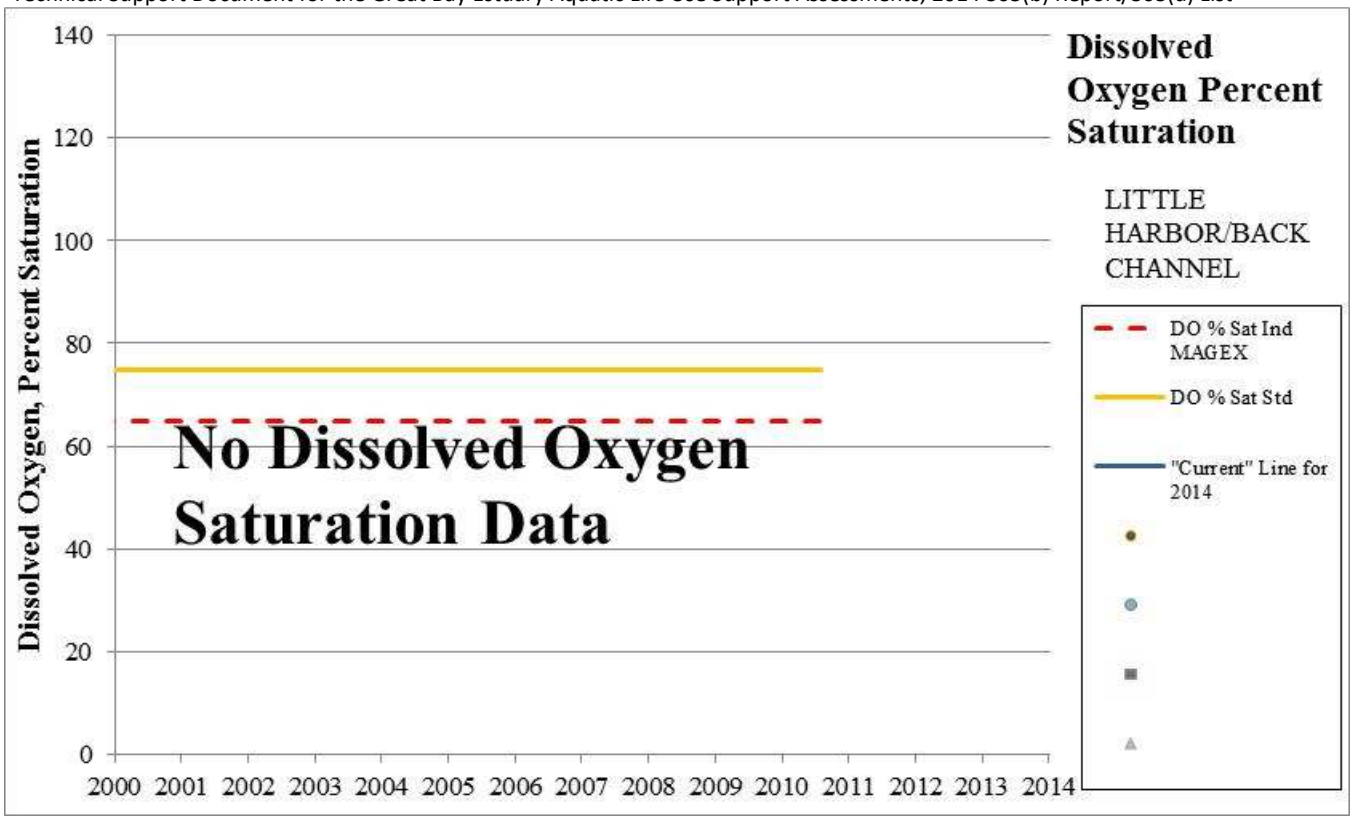
Assessment Zone = LITTLE HARBOR/BACK CHANNEL

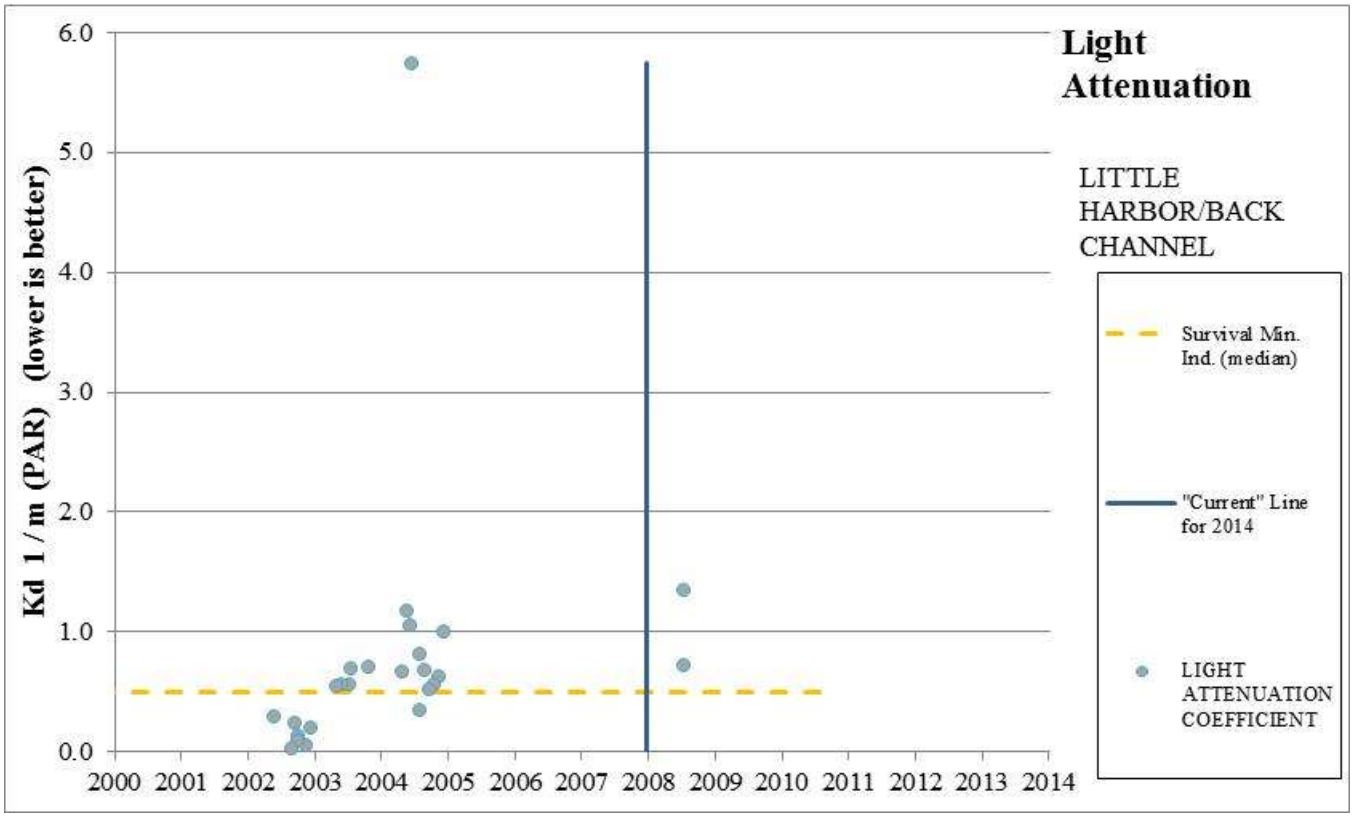
(NHEST600031001-05, NHEST600031001-08, NHEST600031002-02)

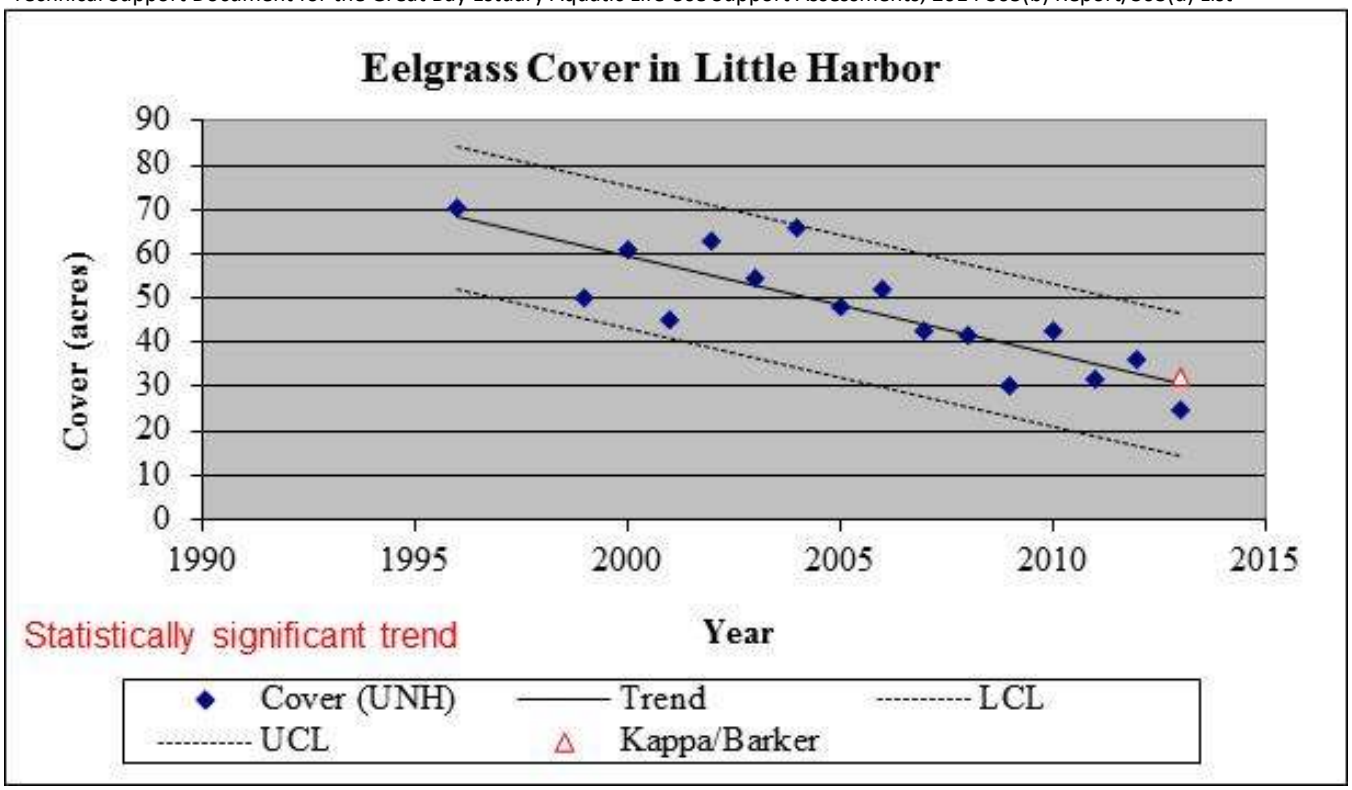
Indicator	Aquatic Life Use Category 2012 / 2014	2014
Chlorophyll-a	3-PAS / 3-PAS	The calculated 90th percentile chlorophyll-a in this assessment zone cannot be calculated due to the presence of only four measured values since 2008 (0.8 to 3.9 ug/L). The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L. The limited available data leads to an assessment of Insufficient Information – Potentially Attaining.
Dissolved Oxygen (mg/L)	2-G / 2-G	This assessment zone has only grab sample measurements for dissolved oxygen concentration and those measurements were only collected up through 2010. The available data indicates that this assessment zone meets the dissolved oxygen concentration criteria.
Dissolved Oxygen (% Saturation)	3-ND / 3-ND	No Data
Estuarine Bioassessments (eelgrass)	5-P / 5-P	The historical extent of eelgrass in this assessment zone was 68.8 acres from the 1948, 1962, 1980, and 1981 datasets. The median current extent of eelgrass in 2011-2013 is 31.6 acres, which is a decrease of 54.1%. Since 1990, the trend in eelgrass cover in this assessment zone is a loss of 33.4%. The thresholds for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	5-M / 5-M	Median=1.046 m^-1 (n=2). For an eelgrass restoration depth of 3 m, the light attenuation coefficient threshold is 0.5 m^-1. This assessment zone historically had eelgrass growing in both the shallows and deeper habitat making the 3m restoration depth a valid target. This assessment zone was listed as impaired (5-M) for water clarity to protect eelgrass habitat on the 2010 303d list. At that time the Light Attenuation Coefficient median was 0.58 m^-1 (n=25). Assessment zones that were impaired in the previous cycle cannot be removed from the 303d list if there are insufficient data to make a new assessment. Therefore, the impaired (5-M) listing from the 2010 and 2012 303d list has been retained.
Total Nitrogen	5-M / 3-PNS	The median total nitrogen from the limited data covering 2008 through 2013 was 465 ug/L (n=4). New Hampshire is no longer comparing ambient total nitrogen data to the total nitrogen numeric indicators used in the 2012 assessment as translators for the narrative water quality criteria. From grab samples only, the dissolved oxygen concentration data in this assessment zone attains standards however there are no usable percent saturation data available. The limited chlorophyll-a data suggests that this assessment zone would meet chlorophyll-a indicator to protect dissolved oxygen. The eelgrass beds are less than half their historic extent. The limited available light attenuation data (median=1.046 m^-1 (n=2)) is inadequate for the 3 m restoration depth. This assessment zone is generally characterized by its lack eutrophication indicator data. Overall, there is insufficient power in the response datasets to determine that eutrophication by total nitrogen is alone is not known to be strong enough to warrant impairment under New Hampshire's narrative standard. As such, this assessment zone has been assessed as Insufficient Information – Potentially Not Supporting (3-PNS) for total nitrogen.

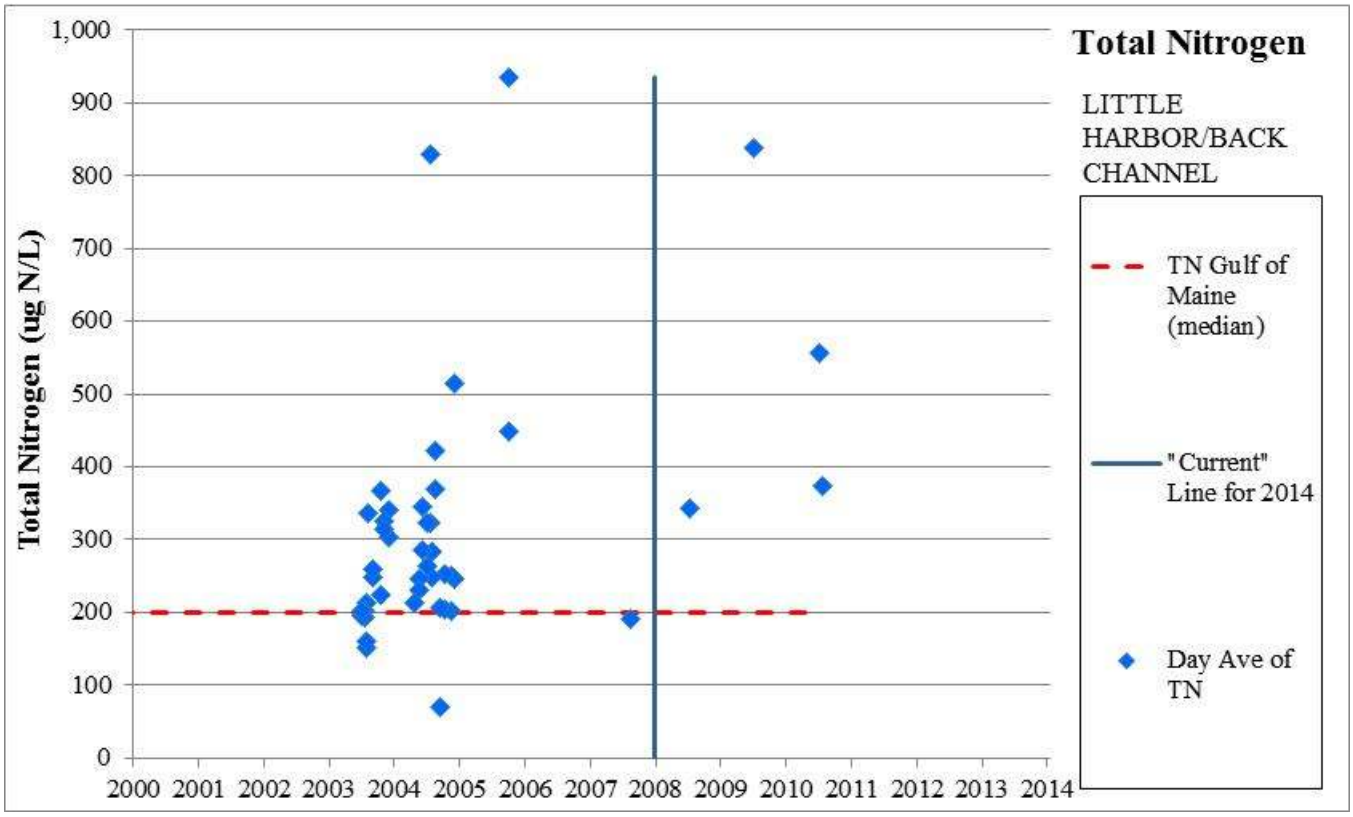

Chlorophyll-a
LITTLE HARBOR/BACK CHANNEL
ug Chl-a / L
0
2
4
6
8
10
12
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Chl-a Ind. (90th percentile)
"Current" Line for 2014
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN


Dissolved Oxygen Concentration
LITTLE HARBOR/BACK CHANNEL
Dissolved Oxygen, mg / L
0
2
4
6
8
10
12
14
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2014
DO-PPM-GRAB-CP
DO-PPM-GRAB-NCP


Dissolved Oxygen Percent Saturation
LITTLE HARBOR/BACK CHANNEL
Dissolved Oxygen, Percent Saturation
140
120
100
80
60
40
20
0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
No Dissolved Oxygen Saturation Data
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2014


Light Attenuation
LITTLE HARBOR/BACK CHANNEL
Kd 1 / m (PAR) (lower is better)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Survival Min. Ind. (median)
"Current" Line for 2014
LIGHT ATTENUATION COEFFICIENT


Eelgrass Cover in Little Harbor
Cover (acres)
90
80
70
60
50
40
30
20
10
0
1990
1995
2000
2005
2010
2015
Statistically significant trend
Year
Cover (UNH)
Trend
LCL
UCL
Kappa/Barker

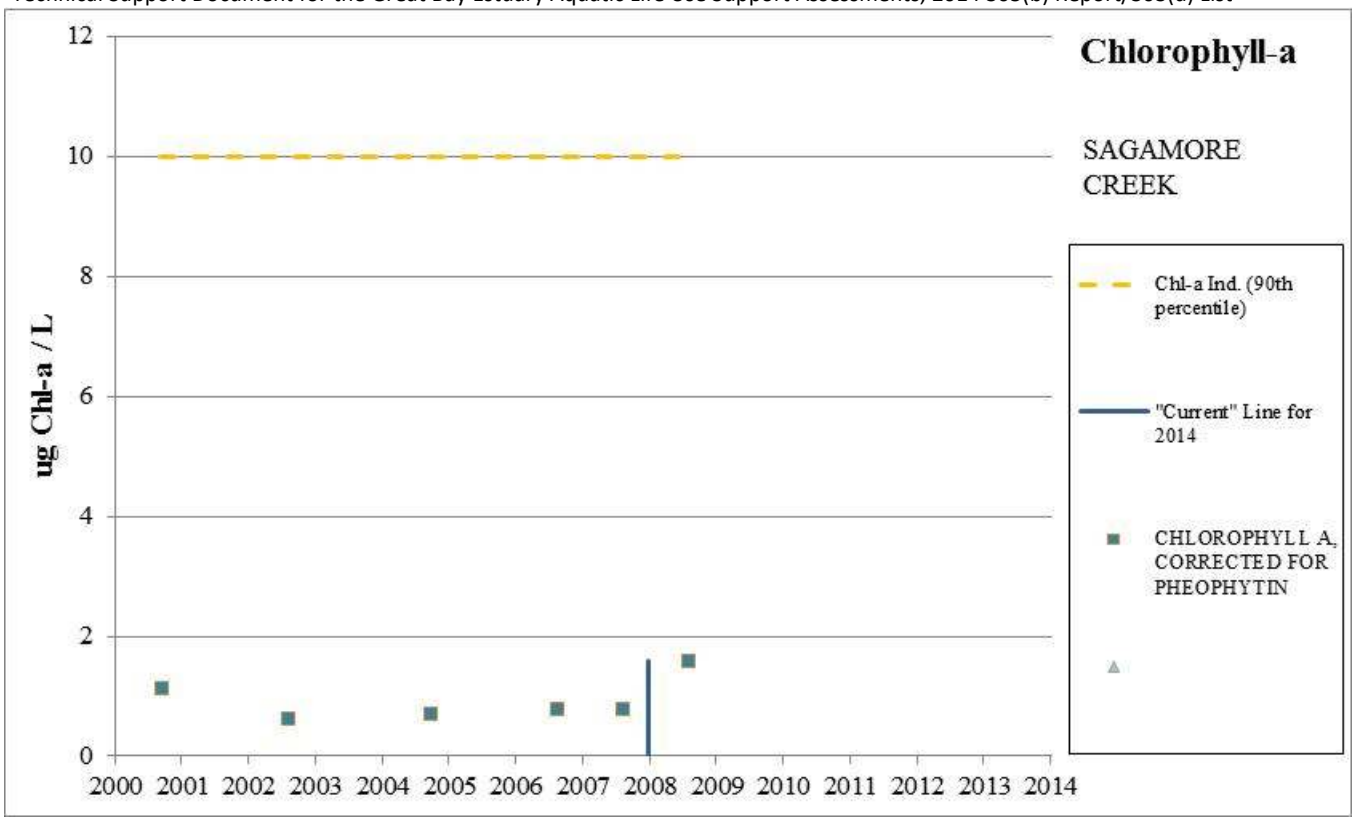

Total Nitrogen
LITTLE HARBOR/BACK CHANNEL
Total Nitrogen (ug N/L)
1,000
900
800
700
600
500
400
300
200
100
0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
TN Gulf of Maine (median)
"Current" Line for 2014
Day Ave of TN

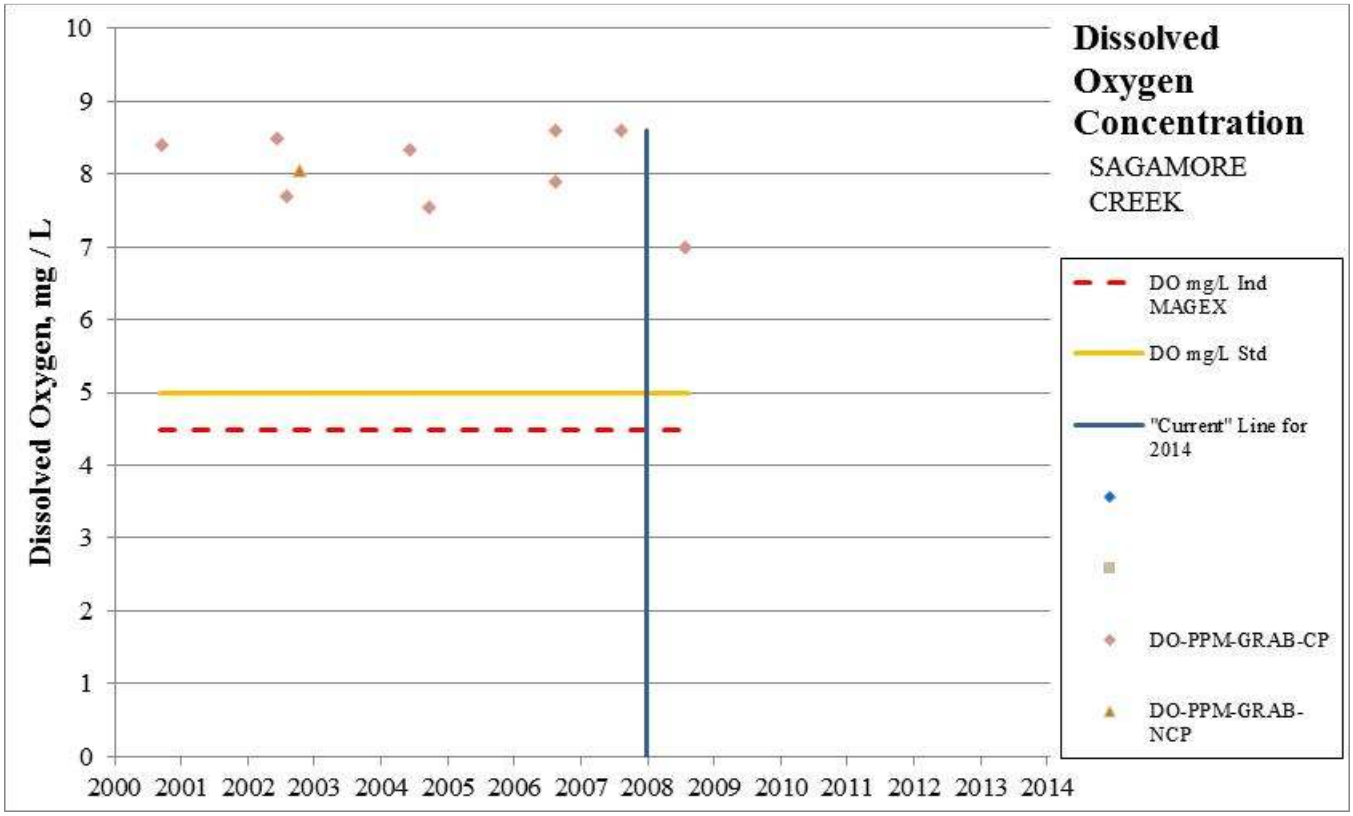
Little Harbor / Back Channel Assessment Zone (January 1, 2008 to November 7, 2014)	**Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	4	0.8	1.3	-	3.9
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	-	-	-	-	-
CHLOROPHYLL A, combined	4	0.8	1.3	-	3.9
DO-PERC-24H-MEAN-CP	-	-	-	-	-
DO-PERC-24H-MEAN-NCP	-	-	-	-	-
DO-PERC-2TIDE-GRAB-CP	-	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP	-	-	-	-	-
DO-PPM-24HR-MIN-CP	-	-	-	-	-
DO-PPM-24HR-MIN-NCP	-	-	-	-	-
DO-PPM-GRAB-CP	15	5.4	7.2	8.9	9.4
DO-PPM-GRAB-NCP	4	8.8	9.6	-	9.8
LIGHT ATTENUATION COEFFICIENT	2	0.736	**1.046**	-	1.356
TURBIDITY	-	-	-	-	-
Day Ave of TN	4	342	**465**	-	837
Day Ave of TDN	4	219	431	-	727
Day Ave of DIN (NH3 + NO2/3)	4	38	117	-	235
Day Ave of NH3	4	16	71	-	195
Day Ave of PON	2	25	34	-	42
Day Ave of NO2/3	4	22	41	-	51

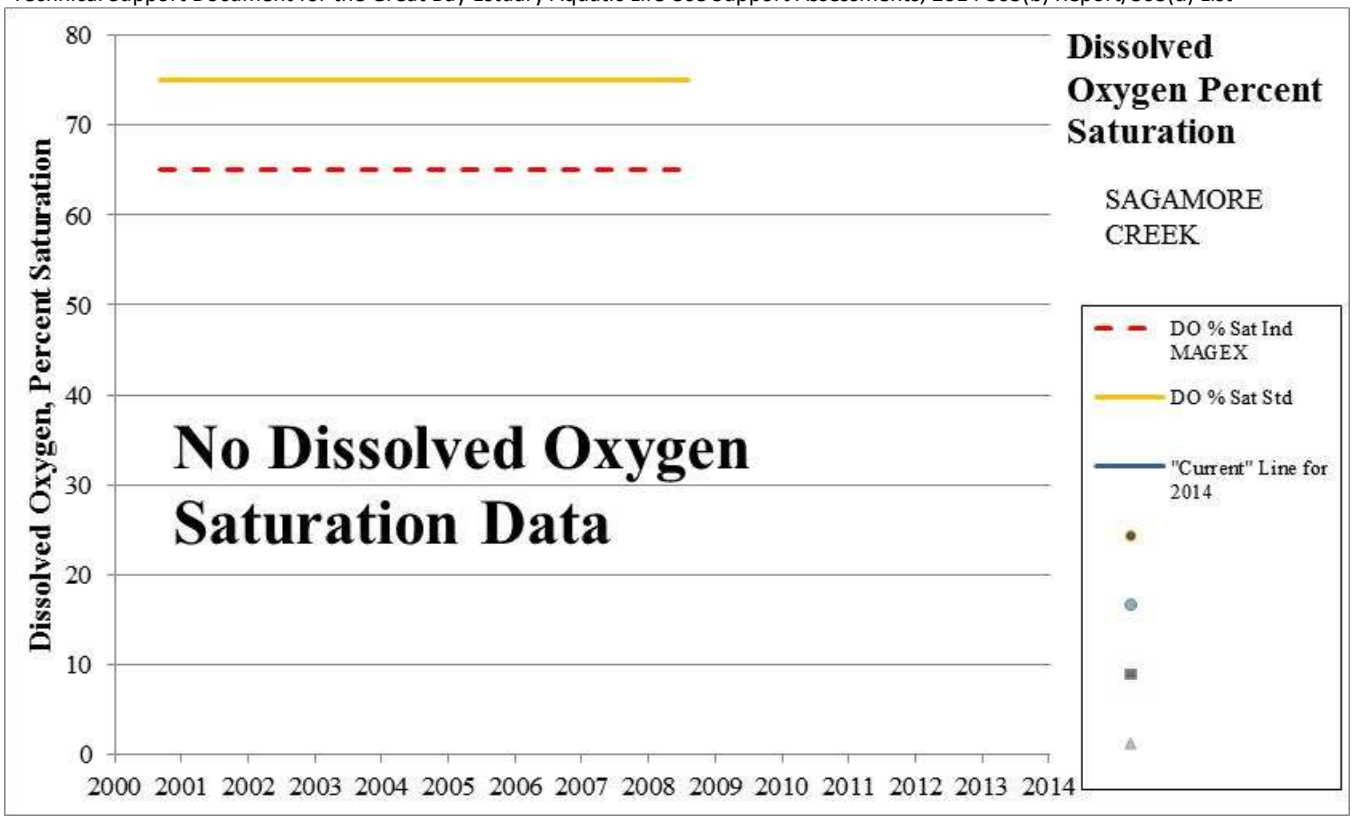
Assessment Zone = SAGAMORE CREEK

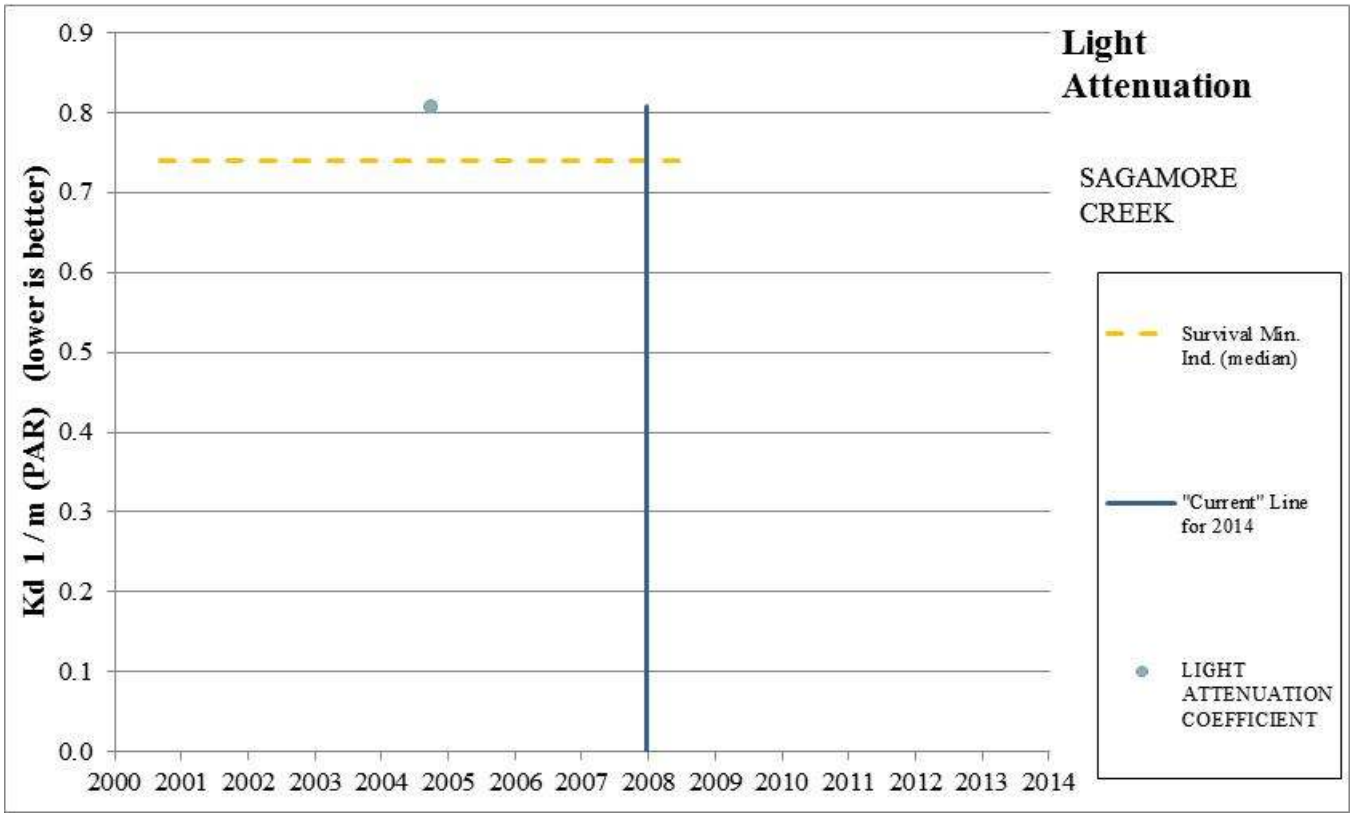
(NHEST600031001-03, NHEST600031001-04)

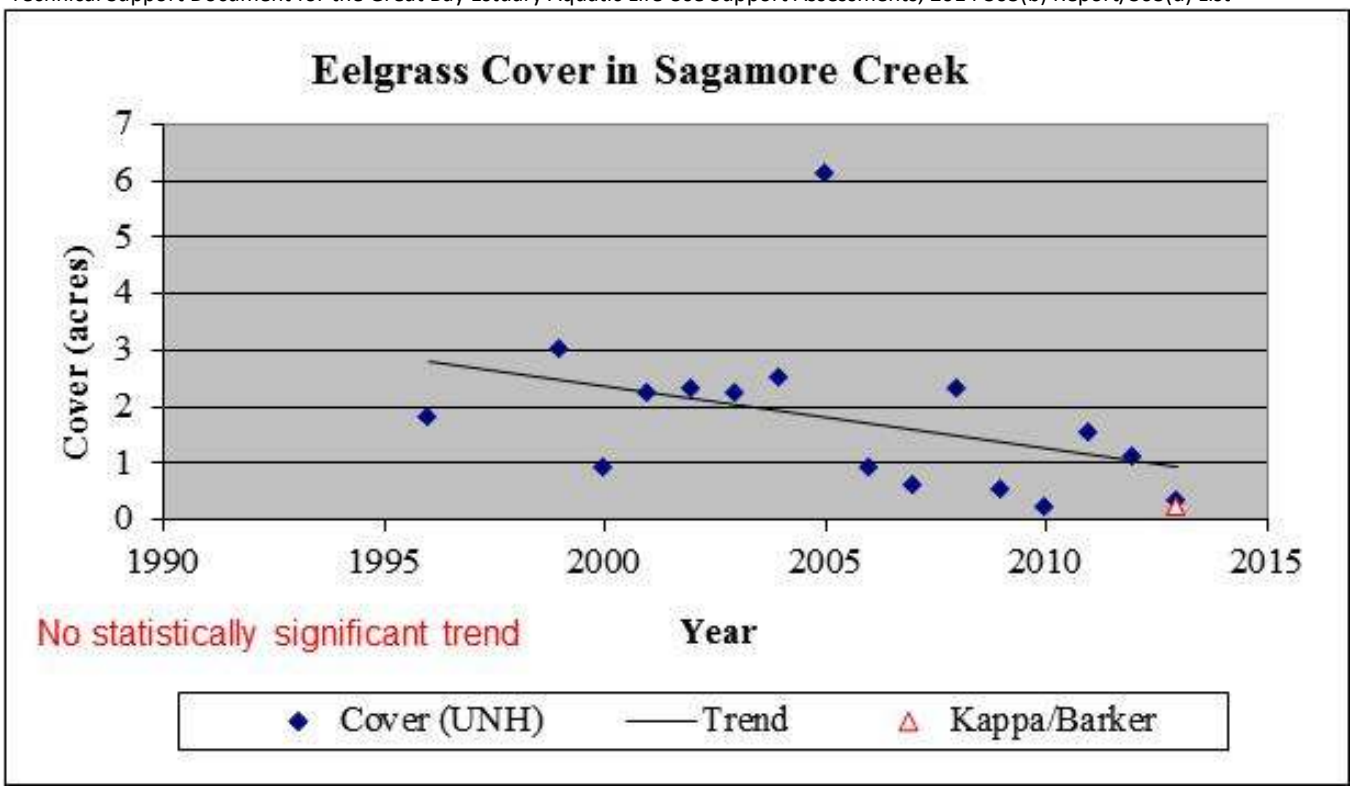
Indicator	Aquatic Life Use Category 2012 / 2014	2014
Chlorophyll-a	3-PAS / 3-PAS	The calculated 90th percentile chlorophyll-a in this assessment zone cannot be calculated due to the presence of only one measured value since 2008 (1.6 ug/L). The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L. The limited available data leads to an assessment of Insufficient Information – Potentially Attaining Standards.
Dissolved Oxygen (mg/L)	3-PAS / 3-PAS	This assessment zone has only grab sample measurements for dissolved oxygen concentration and those measurements were only collected up through 2008. That available data indicates that this assessment zone meets the dissolved oxygen criteria but there are insufficient samples to assess the waterbody as fully supporting.
Dissolved Oxygen (% Saturation)	3-ND / 3-ND	No Data
Estuarine Bioassessments (eelgrass)	5-P / 5-P	The historical extent of eelgrass in this assessment zone was 4.1 acres from the 1948, 1962, 1980, and 1981 datasets. The median current extent of eelgrass in 2011-2013 is 1.1 acres, which is a decrease of 73.3%. Since 1990, the trend in eelgrass cover in this assessment zone was not significant. The threshold for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	3-ND / 3-ND	No Data. This assessment zone historically had eelgrass growing in both the shallows and deeper habitat making the 3m restoration depth a valid target. Further, a review of the location of the deep edge of the eelgrass suggests that the maximum depth of eelgrass survival is not as deep as it was in the past. As there is no measured light attenuation, this zone remains assessed as 'no data'.
Total Nitrogen	3-PAS / 3-ND	Only one sample was collected between 2008 through 2013. New Hampshire is no longer using the numeric total nitrogen indicators used in the 2012 assessment for comparison ambient total nitrogen data. That sample was collected in 60 cm of water as part of the Little Harbor TMDL study during wet weather conditions and had total fecal coliform of 47,200 cts/100mL. While indicative of concentrated loading to this assessment zone, the conditions of the lone sample are not considered representative enough of median nitrogen conditions to be used in the assessment for total nitrogen. total nitrogen samples from 2004 through 2007 ranged from 153 to 198 ug/L. There are no 'current' dissolved oxygen concentration, dissolved oxygen percent saturation, or light attenuation data in the 'current' period and only a single chlorophyll-a sample. The eelgrass beds are severely degraded. There are insufficient data to indicate that the eutrophication is strong enough to warrant impairment. As such, this assessment zone has been assessed as no data for total nitrogen.

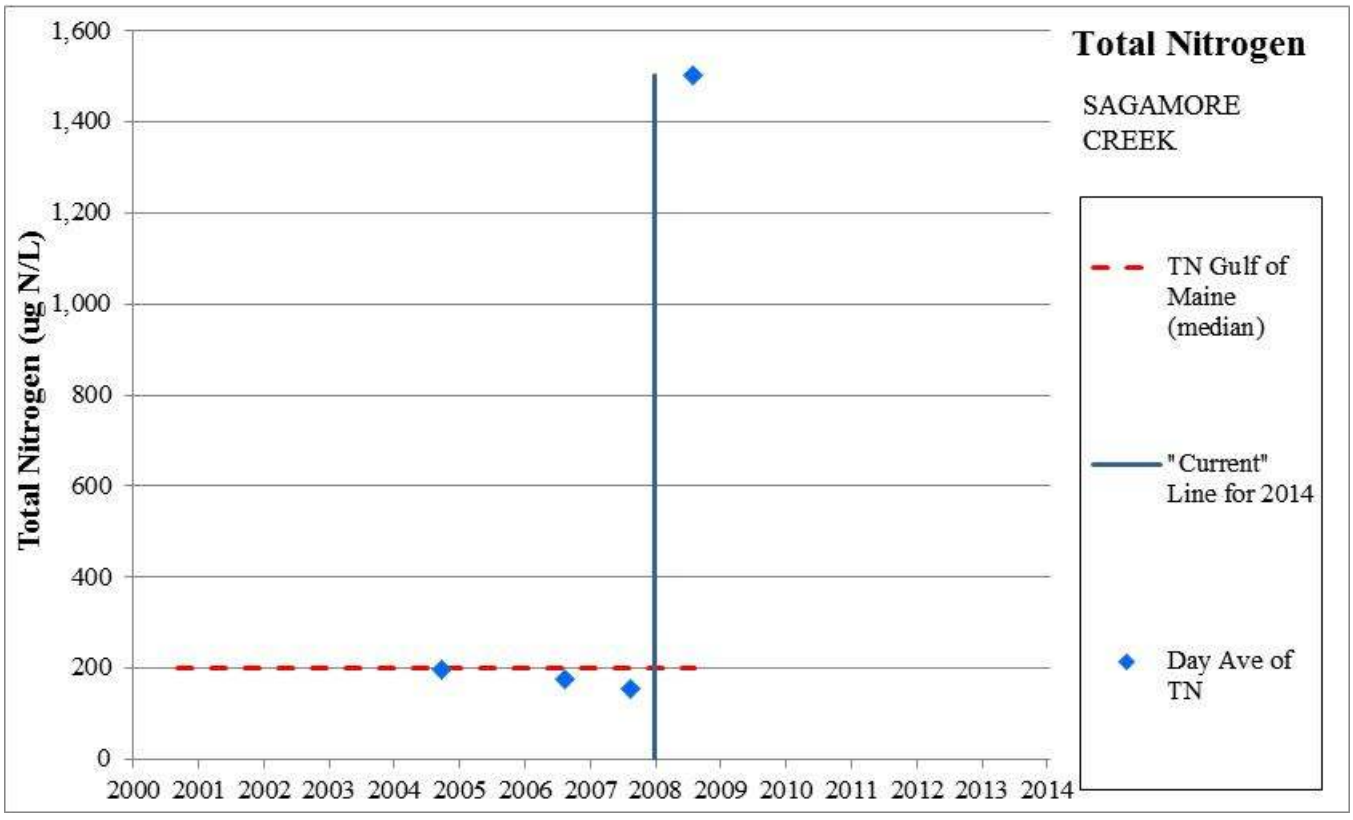

Chlorophyll-a
SAGAMORE CREEK
ug Chl-a / L
Chl-a Ind. (90th percentile)
"Current" Line for 2014
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN
0
2
4
6
8
10
12
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014


Dissolved Oxygen Concentration
SAGAMORE CREEK
Dissolved Oxygen, mg / L
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2014
DO-PPM-GRAB-CP
DO-PPM-GRAB-NCP
0
1
2
3
4
5
6
7
8
9
10
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014


Dissolved Oxygen Percent Saturation
SAGAMORE CREEK
Dissolved Oxygen, Percent Saturation
No Dissolved Oxygen Saturation Data
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2014
0
10
20
30
40
50
60
70
80
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014


Light Attenuation
SAGAMORE CREEK
Kd 1 / m (PAR) (lower is better)
Survival Min. Ind. (median)
"Current" Line for 2014
LIGHT ATTENUATION COEFFICIENT
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014


Eelgrass Cover in Sagamore Creek
Cover (acres)
0
1
2
3
4
5
6
7
1990
1995
2000
2005
2010
2015
No statistically significant trend
Year
Cover (UNH)
Trend
Kappa/Barker


Total Nitrogen
SAGAMORE CREEK
Total Nitrogen (ug N/L)
0
200
400
600
800
1,000
1,200
1,400
1,600
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
TN Gulf of Maine (median)
"Current" Line for 2014
Day Ave of TN

Sagamore Creek Assessment Zone (January 1, 2008 to November 7, 2014)	**Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	1	1.6	1.6	-	1.6
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	-	-	-	-	-
CHLOROPHYLL A, combined	1	1.6	1.6	-	1.6
DO-PERC-24H-MEAN-CP	-	-	-	-	-
DO-PERC-24H-MEAN-NCP	-	-	-	-	-
DO-PERC-2TIDE-GRAB-CP	-	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP	-	-	-	-	-
DO-PPM-24HR-MIN-CP	-	-	-	-	-
DO-PPM-24HR-MIN-NCP	-	-	-	-	-
DO-PPM-GRAB-CP	1	7.0	7.0	-	7.0
DO-PPM-GRAB-NCP	-	-	-	-	-
LIGHT ATTENUATION COEFFICIENT	-	-	-	-	-
TURBIDITY	-	-	-	-	-
Day Ave of TN	1	1,501	**1,501**	-	1,501
Day Ave of TDN	1	975	975	-	975
Day Ave of DIN (NH3 + NO2/3)	1	667	667	-	667
Day Ave of NH3	1	241	241	-	241
Day Ave of PON	-	-	-	-	-
Day Ave of NO2/3	1	426	426	-	426

References

Burdick, D., Mathieson, A., Peter, C., & Sydney, N. (2016). *Monitoring Macroalgae in the Great Bay Estuary for 2014.* Piscataqua Region Estuaries Partnership.

Howes, B., Samimy, R., & Dudley, B. (2003). *Site-Specific Nitrogen Thresholds for Southeastern Massachusetts Embayments: Critical Indicators.* Th Schoool for Marine Science and Technology, U. Mass. Dartmouth.

Howes, B., Samimy, R., Schlezinger, D., & Eichner, E. (2013, March). *Linked Watershed-Embayment Model to Determine Critical Nitrogen Loading Thresholds for the Quissett Harbor Embayment System, Town of Flamouth, Massachusetts.* U Mass. Dartmouth, School of Marine Science and Technology. Ecological Society of America.

HydroQual. (March 20, 2012). *Squamscott River August-September 2011 Field Studies.* HydroQual.

McGlathery, K., Sundbäck, K., & Anderson, I. (2007, October 25). Eutrophication in shallow coastal bays and lagoons: the role of plants in the coastal filter. *Marine Ecology Progress Series, Vol. 348*, pp. 1-18.

NHDES. (2008). *New Hampshire's 2012 Section 305(b)/303(d) List, Technical Support Document, Assessments of Aquatic Life Use Support in the Great Bay Estuary for Chlorophyll-a, Dissolved Oxygen, Water Clarity, Eelgrass Habitat, and Nitrogen. (R-WD-08-18).*

NHDES. (2009). *Numeric Nutrient Criteria for the Great Bay Estuary. New Hampshire Department of Environmental Services, Concord, NH. June 2009. (R-WD-09-12).*

NHDES. (2013). *Response to Public Comment and Summary of Substative Differences Between the Draft and Final 2012 Section 303(d) Surface Water Quality Report, July 19,2013.* NHDES.

Pe'eri, S., Morrison, J. R., Short, F., Mathieson, A., Brook, A., & Trowbridge, P. (2008). *Macroalgae and eelgrass mapping in Great Bay Estuary using AISA hyperspectral imagery. A Final Report to the Piscataqua Region Estuaries Partnership from the University of New Hampshire, Durham, NH. December 2008.*

PREP. (2013). *State of Our Estuaries.* Durham, NH: Piscataqua Region Estuaries Partnership.

Short, F., Davis, R. C., Kopp, B. S., Short, C. A., & Burdick, D. M. (2002). Site-selection model for optimal transplantation of eelgrass Zostera marina in the northeastern US. *227*, 253-267.

USEPA. (2015). *Approval of New Hampshire's 2012 303(d) (Sept. 24, 2015).* United States Environmental Protection Agency.

Valiela, I., Collins, G., Kremer, J., Lajtha, K., Geist, M., Seely, B., et al. (1997). Nitrogen Loading from Coastal Watersheds to Receiving Estuaries: New Method and Application. *Ecological Applications, 7*(2), pp. 358-380.

Wazniak, C., Hall, M., Carruthers, T., Sturgis, B., Dennison, W., & Orth, R. (2007). Linking Water Quality to Living Resources in a Mid-Atlantic Lagoon System, USA. *Ecological Applications, 17*(5), S64-S78.